CESA Incidental Take Permit Application for the Emergency Drought Barriers Project

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Acronyms and Abbreviations

APNs	Assessor Parcel Numbers
BAAQMD	Bay Area Air Quality Management District
Basin Plan	Water Quality Control Plan
BMPs	Best Management Practices
BOs	Biological Opinions
Cal Boating	California Department of Parks and Recreation Division of Boating and Waterways
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CMP	Carl Moyer Program
CNDDB	California Natural Diversity Database
CPTs	cone penetrometer tests
CVP	Central Valley Project
dB re: 1μPa^2-s	1 micropascal squared per second
DCC	Delta Cross Channel
Delta	Sacramento-San Joaquin River Delta
DWR	Department of Water Resources
EC	electrical conductivity
EDB	Emergency Drought Barriers Project
HAS	hollow stem auger
ITP	Incidental Take Permit
LMA	Local Maintaining Agency
mg/L	milligrams per liter
mm	millimeter
NMFS	National Marine Fisheries Service
NO_X	oxides of nitrogen
NTUs	Nephelometric Turbidity Units
OMR	Old and Middle River
RMS	root mean square
RSTs	rotary screw traps
SEL	sound exposure level
SFBAAB	San Francisco Bay Area Air Basin
SMAQMD	Sacramento Metropolitan Air Quality Management District
SWP	State Water Project
USFWS	U.S. Fish and Wildlife Service
μPa	micropascal

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The California Department of Water Resources (DWR) is submitting this application for a California Endangered Species Act (CESA) Incidental Take Permit (ITP) for the Emergency Drought Barriers Project to the California Department of Fish and Wildlife (CDFW), pursuant to Fish and Game Code Section 2081(b) and Section 2081(c), and California Code of Regulations, Title 14, Subdivision 3, Chapter 6, Article 1, commencing with Section 783.

1. Applicant

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2. Covered Species

The species covered in this ITP application, and their listing status, are presented in Table 1. Among the listed fishes, only discussion of longfin smelt is included in this document, whereas the remaining fish species are discussed in the Biological Assessment of Potential Effects on Listed Fishes from the project, prepared for the Federal Endangered Species Action Section 7 consultation with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). Please refer to the biological assessment for the necessary analysis of impacts and potential for incidental take of delta smelt, winter-run chinook salmon, and spring-run chinook salmon.

Table 1. Covered Species

Name	Status
Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened
Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*)	Endangered
Delta smelt (*Hypomesus transpacificus*)	Endangered
Longfin smelt (*Spirinchus thaleichthys*)	Threatened
Swainson's hawk (*Buteo swainsoni*)	Threatened

2.1 Other Species Considered

Potential for the project to result in take of other state-listed species was evaluated based on review of various information sources regarding the status of the species in the Sacramento-San Joaquin River Delta (Delta) and observations made by biologists during a survey of each proposed barrier location conducted on March 13 and 14, 2014. Mason's lilaeopsis (*Lilaeopsis masonii*), giant garter snake (*Thamnophis gigas*), and California black rail (*Laterallus jamaicensis coturniculus*), were considered for inclusion as covered species but rejected because they are unlikely to occur at any of the project sites, for the reasons described below.

2.1.1 Mason's Lilaeopsis

Mason's lilaeopsis occurs along the edge of rivers and sloughs throughout the Delta, particularly the central and west Delta (DWR 2013). Extensive surveys for the species were conducted in the Delta in 2009. The study area included the Sutter Slough and West False River project sites and the northern section of Steamboat Slough, to within approximately 100 feet of the emergency drought barriers (EDB) and boat ramp footprint. No occurrences of the species were documented in the immediate vicinity of any of the sites during these surveys (Witzman, pers. comm., 2014). The nearest documented occurrences of Mason's lilaeopsis are approximately 0.5 mile east and west of the West False River barrier location and approximately 4 miles west of the Sutter and Steamboat slough locations (along the Sacramento Deepwater Ship Channel) (DWR 2013). Observations made during March 2014 field surveys of the project sites confirmed habitat at the Steamboat Slough and West False River Project sites is of poor quality and not likely to support the species. Potentially suitable habitat was observed on the west bank of Sutter Slough, immediately upstream and downstream of the project site, but it is unlikely the species occurs here, based on negative results from the 2009 focused surveys. In the unlikely event that Mason's lilaeopsis becomes established at any of the project sites, implementation of the environmental commitment described in section 3.8.28 of this application would ensure that potential for adverse effects is minimized and take of Mason's lilaeopsis is avoided.

2.1.2 Giant Garter Snake

A large portion of the Delta has not been comprehensively surveyed for giant garter snake, primarily because the majority of land is privately owned. Historical and recent surveys have failed to identify extant population clusters in the region (Hansen 1986; Patterson 2003, 2005; Patterson and Hansen 2004), including during DWR surveys of various Delta sites in 2009. However, individuals have been trapped at White Slough Wildlife Area and several photographed near Little Connection Slough (USFWS 2012). More recent observations have been made at additional locations in the vicinity of Little Connection Slough and farther south in the Delta. These suggest viable populations of giant garter snake may persist in the eastern portion of the Delta. The nearest of these occurrences was over 9 miles east of the West False River project site.

The California Natural Diversity Database (CNDDB) includes two relatively recent observations of giant garter snakes closer to the West False River site, a 2002 observation approximately 1.5 miles east of the site and a 2010 observation approximately 5 miles southwest of the site. Two older occurrences are also documented in the CNDDB, a 1998 observation approximately 3.5 miles northwest of the site and a pre-1986 specimen collected in the vicinity of the 2002 observation. The origin of these snakes is uncertain, but there is speculation that recent observations in the central Delta were of snakes that occasionally move into the region by 'washing-down' from known populations and that these occurrences do not represent local breeding populations (Hansen pers. comm. in DWR 2013). Therefore, occurrences near the West False River project site may represent single displaced snakes, not viable populations like those in the eastern Delta. CNBBD occurrences nearest to the Sutter Slough and Steamboat Slough project sites are from approximately 4 miles east and include an unknown number of snakes observed in 1992 and pre-1986 at and near Snodgrass Slough.

The potential for giant garter snakes to occur in the vicinity of the project sites is low. All three of the sites are many miles from any known populations of the species, and none of the sites provide high-quality habitat for the species. Although the sloughs provide marginally suitable aquatic habitat, suitability of bankside habitat at all sites is limited. The Sutter Slough and Steamboat Slough project sites have a nearly continuous canopy of riparian shrubs and trees along the banks, and land uses adjacent to these sites are dominated by orchards and other unsuitable agricultural crops (as seen in the aerial photographs of Figures 3 and 4). Uplands adjacent to the West False River site are more suitable for giant garter snake, but, as described above, occurrence of giant garter snake in this part of the Delta is likely rare and may be accidental.

None of the potential material storage areas support suitable aquatic habitat for giant garter snake, nor is suitable aquatic habitat present within 200 feet of the sites. The area immediately north of the Rio Vista location could support aquatic habitat beyond 200 feet, but the storage site does not provide suitable upland habitat for the species. In addition, this region is not thought to support any giant garter snake populations.

2.1.3 California Black Rail

Suitable habitat for California black rail in the Delta is restricted to remnant wetland sites that are generally unavailable for agricultural uses. Surveys conducted by CDFW in the early 1990s found small numbers of black rails at several locations in the central Delta and at the lower reach of the Sacramento River (DWR 2013). DWR conducted focused surveys for black rails in the Delta in 2009 and 2010 and found nesting pairs at White Slough Wildlife Area and on several mid-channel islands (DWR 2013). Black rails were detected throughout the interior Delta, primarily on large in-stream islands with dense vegetative cover. They were also found in an irrigated pasture with wetland vegetation at the DWR Dutch Slough restoration site and in the tidal marsh fringing the south side of Big Break. Surveys were conducted at Prospect Island, approximately 4 miles southwest of the Sutter Slough and Steamboat Slough Project sites, but no rail were detected there (Tsao, pers. comm., 2014). More recently, black rails were observed in fall 2014 using mid-channel islands with tidal wetland habitat along Lindsey Slough (Estrella, pers. comm., 2015). Based on habitat preferences documented during these surveys and observations made during the March 2014 field surveys, none of the project sites support suitable habitat conditions for California black rail.

3. Project Description

3.1 Introduction

Water quality conditions in the Delta during 2014 were difficult to control as a result of persistent drought conditions, and put municipal, industrial, and agricultural water supplies at risk. The brackish conditions also were degrading habitat for threatened and endangered fish dependent on the Delta. In response to the statewide drought conditions, the U.S. Department of Agriculture identified 57 counties in California, including Sacramento, Yolo, and San Joaquin counties, as eligible for natural disaster assistance, including funding for emergency watershed protection and water assistance for rural communities (USDA 2014) . This announcement came in the spring of 2014, following President Obama's earlier announcement of an administration-wide drought response in February 2014.

In addition, on January 17, 2014, California's Governor Edmund G. Brown Jr. signed a proclamation declaring a State of Emergency, prompted by record dry conditions and projections that 2014 would be the driest year on record (see http://gov.ca.gov/news.php?id=18368). In his proclamation, he found that the lack of precipitation is beyond the ability of local authorities to address, placing the safety of people and property existing within California in peril because of water shortage from persistent drought conditions. Governor Brown issued a number of directives calling for immediate action to implement conservation programs, secure water supplies for at-risk communities, and protect critical environmental resources. A Proclamation of a Continued State of Emergency was issued on April 25, 2014, and an Executive Order was issued on December 22, 2014 extending the waiver of the California Environmental Quality Act and Water Code Section 13247 in paragraph 9 of the January 17, 2014 Proclamation, and paragraph 19 of the April 25, 2014 Proclamation through May 31, 2016.

Many of the actions in the drought proclamation are being undertaken by DWR and its various federal, state, and local partners. These actions include temporary modifications of requirements included in the State Water Resources Control Board's Revised Decision 1641 (D-1641) to meet water quality objectives in the Water Quality Control Plan for the Bay-Delta, including increased flexibility for water transfers, regulating diversions, and Delta Cross Channel (DCC) gate operations. The drought proclamation also directed DWR to take other necessary actions to protect water quality and water supply in the Delta, including installation of temporary barriers or temporary water supply connections as needed, and coordination with CDFW to minimize impacts on affected aquatic species.

The proposed project seeks to protect the quality of water for users that rely on Delta water. The proposed project would include installation of three temporary rock barriers. The selection of the locations of the emergency drought barriers was based mainly on the Draft Emergency Barriers Report from 2009 (DWR 2009). In that report, the impact on salinity at the export locations for various individual locations and a combination of barrier locations was evaluated. For each barrier or combination of barriers, improvement in salinity at the export locations was evaluated and if the improvement was less than 5 percent, the barrier(s) was not considered a viable alternative and other barriers and combinations of barriers became the focus. Based on that analysis, two possible combinations of barriers were chosen. After further analysis, the combination of Steamboat Slough, Sutter Slough, and West False River was decided on to minimize impacts while meeting the project objectives.

The proposed barriers at the heads of both Sutter and Steamboat sloughs would decrease the rate of flow from the Sacramento River and into Sutter and Steamboat sloughs, therefore increasing the flow of water in the Sacramento River. Therefore, increased flows through Georgiana Slough and the DCC would repel salinity from the Central/South Delta. An additional barrier in West False River near its confluence with the San Joaquin River would be installed to limit salinity intrusion along the lower San Joaquin River and the channels leading from it.

Setting precedent for the proposed project, several rock barriers were installed at Delta locations during 1976 and 1977 to help mitigate for drought conditions. In 1976, one barrier was installed at Sutter Slough to help meet water quality criteria, and allow for conserving additional water in upstream reservoirs. A second barrier was installed at Old River at its divergence from the San Joaquin River (often referred to as head of Old River) to protect fishery resources by keeping special-status fish in the San Joaquin River, thereby reducing entrainment risk at Central Valley Project/State Water Project (CVP/SWP) export facilities in the South Delta. In 1977, as drought conditions continued, barriers were installed at six different locations in the Delta. In addition, control facilities were built at two additional locations. The six barrier locations constructed in 1977 included Old River east of Clifton Court, San Joaquin River near Mossdale, Rock Slough, Indian Slough, Dutch Slough, and the head of Old River.

With the proposed project, the temporary barriers could be installed up to three times over a 10-year period between 2015 and 2025, including potentially in successive years. While this document covers the possibility of either three consecutive year installations or up to three installations in 10 years, the barriers would only be constructed if the drought reduces SWP water storage to critical levels such that projected Delta outflow would not control increased salinity in the Delta and worsening water quality threatens the drinking and irrigation water supply, as described in section 3.2 *Purpose of and Need for the Project*. Operation of the drought barriers as part of the overall CVP and SWP operations occurs through existing rules and regulations under relevant federal and state regulatory agencies (for more information on the CVP and SWP Operations Criteria and Plan see http://www.usbr.gov/mp/cvo/ocap_page.html).

Installation of the proposed project in 2015 is considered as part of the Interagency 2015 Drought Contingency Strategy developed by Bureau of Reclamation, DWR, USFWS, NMFS, and CDFW. The December 11, 2014 draft of the Interagency 2015 Drought Contingency Strategy includes several core principles for CVP and SWP operations, one of which is to control salt water intrusion in the Delta. As noted in the draft, installation of emergency drought barriers will be considered in 2015 only when necessary to lessen water quality impacts if winter forecasts suggest that there will be insufficient water in upstream reservoirs without installation of the barriers necessary to protect water quality and to meet health and safety and other critical water supply needs.

3.2 Purpose of and Need for the Project

3.2.1 Purpose of Project

The purpose of the proposed project is to reduce the intrusion of saltwater into the Delta during drought conditions when stored water in upstream reservoirs is insufficient to meet Delta outflow required to repel San Francisco Bay salinity, which could (1) render Delta water undrinkable and affect roughly 25 million Californians, (2) render Delta water unusable by agriculture, and (3) decrease freshwater habitat in the Delta for sensitive aquatic species.

The project objectives are to:

- Benefit communities and farmers in and adjacent to the Delta that rely exclusively on this source for drinkable water and irrigation;
- Benefit upstream resources and communities, because once installed, the barriers would reduce demand on reservoir releases to maintain salinity objectives in the Delta, thus leaving more water in upstream reservoirs that could later be released for critical upstream fisheries and community needs; and
- Benefit the CVP and SWP operators as they attempt to maintain access to water supplies for human health and safety.

3.2.2 Need for Project

EDB would be installed to protect the water supply for nearly all those dependent on the water in the Delta if water quality conditions in the Delta decline due to the severe drought conditions. Increased salinity in the Delta could render the water undrinkable by 25 million Californians and unusable by farms reliant upon this source. In January 2014, large amounts of saltwater began intruding into the Delta. The resulting water quality approached human health criteria at many locations in the South Delta and spread as far south as the CVP and SWP intakes near Tracy, putting several communities and local water purveyors dependent on that water supply at risk. The bromide levels also increased along with salinity (bromide concentrations are typically low in freshwater and higher in seawater). This is important because bromide plays a role in the formation of disinfection by-products (trihalomethanes and bromate), which are carcinogens and difficult to treat with existing drinking water purification processes.

The Delta is a complex system of interconnecting channels that provide numerous pathways for the tides to push saltwater inland. Normally, outflow is sufficient to prevent San Francisco Bay's saline water from migrating eastward into the Delta with each tidal pulse, but the record dry January experienced dramatically lower outflow levels. Because of the degraded water conditions during the start of 2014, temporary emergency drought barriers at strategic locations were evaluated for their potential to repel and minimize saltwater intrusion into the Delta and thus help conserve limited fresh water resources in upstream reservoirs. Runoff and snow pack data show that February and March storms in 2014 increased reservoir storage modestly. While not nearly enough to take California out of the current extreme drought, this minimal increase in water supply allowed the CVP and SWP to limit saltwater intrusion into the interior Delta without installing rock barriers in Delta channels in 2014 (DWR 2014a).

The 2014 CVP and SWP Drought Operations Plan and Operational Forecast for April 1, 2014 through November 15, 2014 called for DWR to reassess the need for barriers in the future if dry conditions persist. This ITP application is being prepared should another drought occur between 2015 and 2025, and water quality monitoring and reservoir storage capacity data indicate that barriers are needed to reduce the intrusion of saltwater into the Delta during drought conditions when upstream reservoir resources are insufficient to meet Delta outflow required to repel San Francisco Bay salinity.

Water content in the Sierra Nevada snowpack that normally provides about a third of the water for California cities and farms was at only 32 percent of its historical average in early April 2014 and was down to 21 percent of its historical average by mid-April (DWR 2014a).

As of mid-April 2014, the state's key reservoirs were well below normal levels. For example, Lake Oroville in Butte County, the SWP's principal reservoir, was at 52 percent of its 3.5 million acre-foot capacity (66 percent of its historical average for the date). Shasta Lake north of Redding, California's and the federal CVP's largest reservoir, was at 53 percent of its 4.5 million acre-foot capacity and 63 percent of its historical average for mid-April. San Luis Reservoir, a critical south-of-Delta pool for both the CVP and SWP, was at 46 percent of its 2 million acre-foot capacity (52 percent of normal for the date) as of mid-April (DWR 2014a).

Should there be insufficient water in the natural runoff or stored in upstream reservoirs that can be released to minimize saline intrusion into the Delta, low Delta tributary inflows will allow salinity intrusion to the extent that interior portions of the Delta will exceed water quality objectives. The maximum mean daily salinity objective for municipal and industrial use in all water year types established by the State Water Resources Control Board in D-1641 is approximately 415 milligrams per liter (mg/L) (Table 1, Water Quality Objectives for Municipal and Industrial Beneficial Uses). Should salinity peak and exceed this threshold, such high salinity levels (with associated bromide levels) could preclude pumping and/or compromise municipal and irrigation water supplies. This would be particularly devastating for communities without alternative water supplies, including the Contra Costa Water District, which serves approximately 500,000 people and is almost entirely dependent on the Delta for its water supply (Contra Costa Water District 2011), and for agricultural water users that may not have access to alternative water supplies.

After salinity intrudes into the Delta, moving it back toward San Francisco Bay is difficult; thus, high salinity could persist for an extended period if high winter and spring freshwater flows are not available to dislodge it. This would effectively eliminate the Delta as a water supply for the Californians who depend on it. This condition would exist, perhaps for many months, until sizeable storms provide the necessary Delta tributary inflow and outflow to flush out the saline waters. In addition to critical urban water uses, water flowing through the Delta is essential to the agricultural industry and businesses that drive the state's economy (DWR 2014b). Consequently, increased salinity levels in the Delta, especially over a sustained period of many months, would have a profound detrimental effect throughout the State.

Increased salinity levels also would have an adverse effect on the sensitive aquatic resources that live in and pass through the Delta. This is both due to exceedances of water quality objectives and because the already limited water supplies stored in the upstream reservoirs would need to be released to meet objectives. As a result, cool water resources would be insufficient in late spring and summer to protect salmon eggs incubating in the gravels, and rearing habitat for juvenile salmon below Keswick, Oroville, and other dams would be depleted. Construction of the barriers would conserve cold water pools in upstream reservoirs to protect natural resource values later in the year because less water would need to be released from the reservoirs for water quality earlier in the year. In addition, more reservoir storage would be available for community needs in upstream areas.

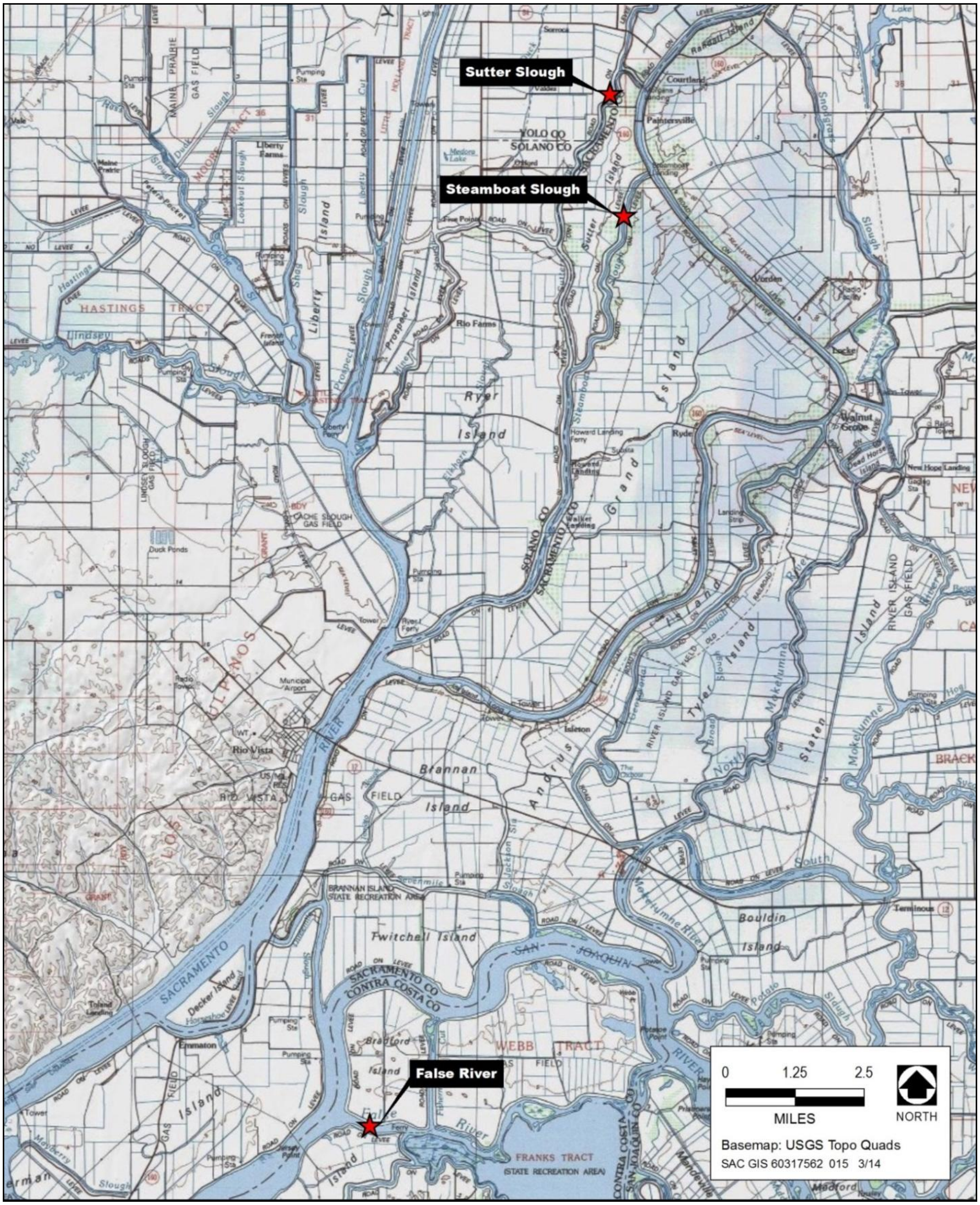
The EDB would impede the intrusion of saltwater into the Central and South Delta and optimize the use of fresh water flows to maintain water quality that meets human health criteria. Modeling of salinity intrusion with variable installation dates demonstrated the greatest benefits are gained if the barriers are installed in spring; however, benefits are gained from a later installation.

3.3 Project Location

Three temporary rock barriers would be installed at three locations in the North and Central Delta:

- Sutter Slough
- Steamboat Slough
- West False River

The general locations of these sites are shown in Figures 1 and 2, and their specific locations are shown in Figures 3 through 5. Photographs of the levee banks at the project sites for the Sutter Slough, Steamboat Slough, and West False River barriers are presented in Figures 6 through 8, respectively.

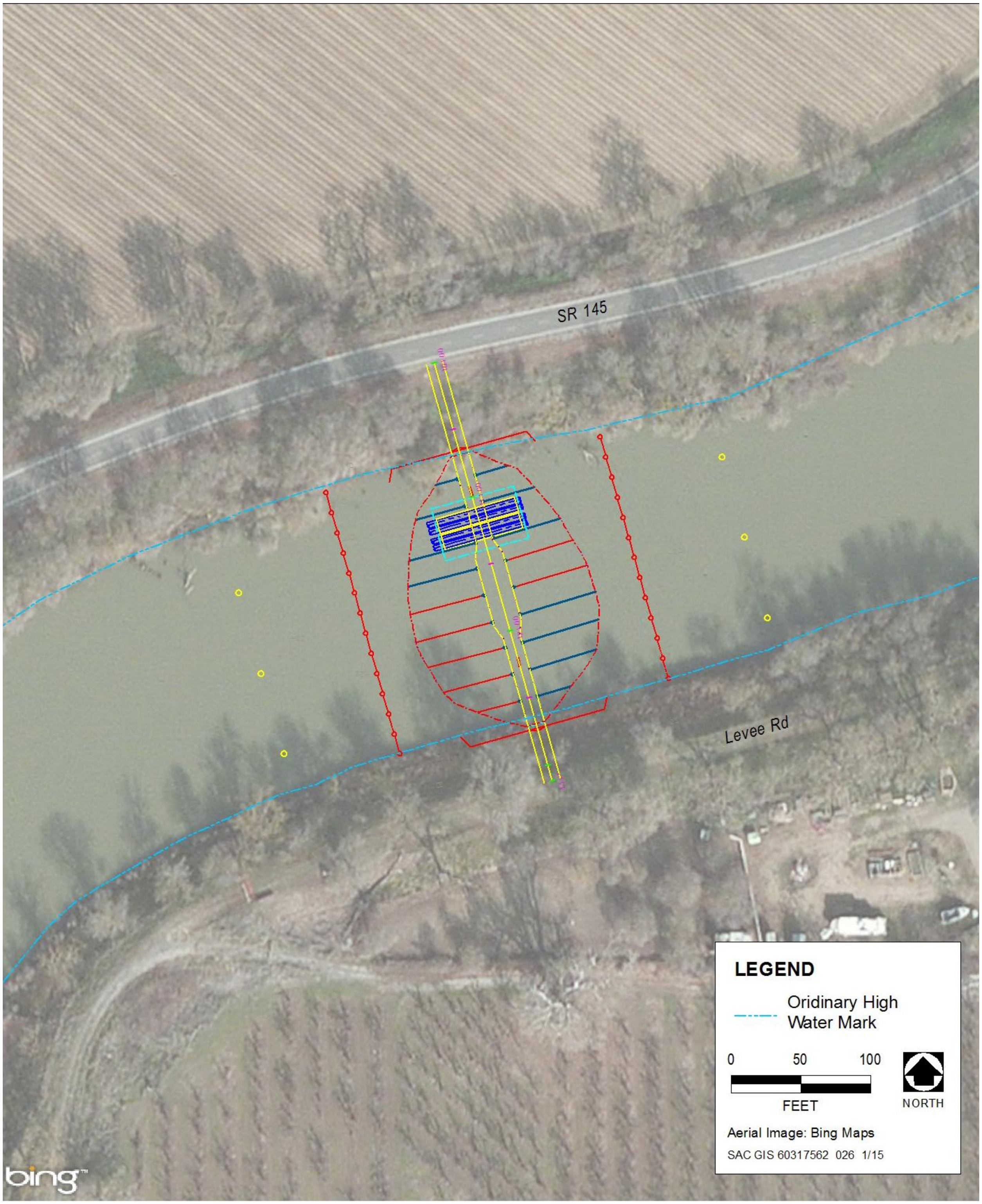


Source: Moffatt & Nichol 2014, AECOM 2014

Figure 1. Locations of Proposed Emergency Drought Barriers

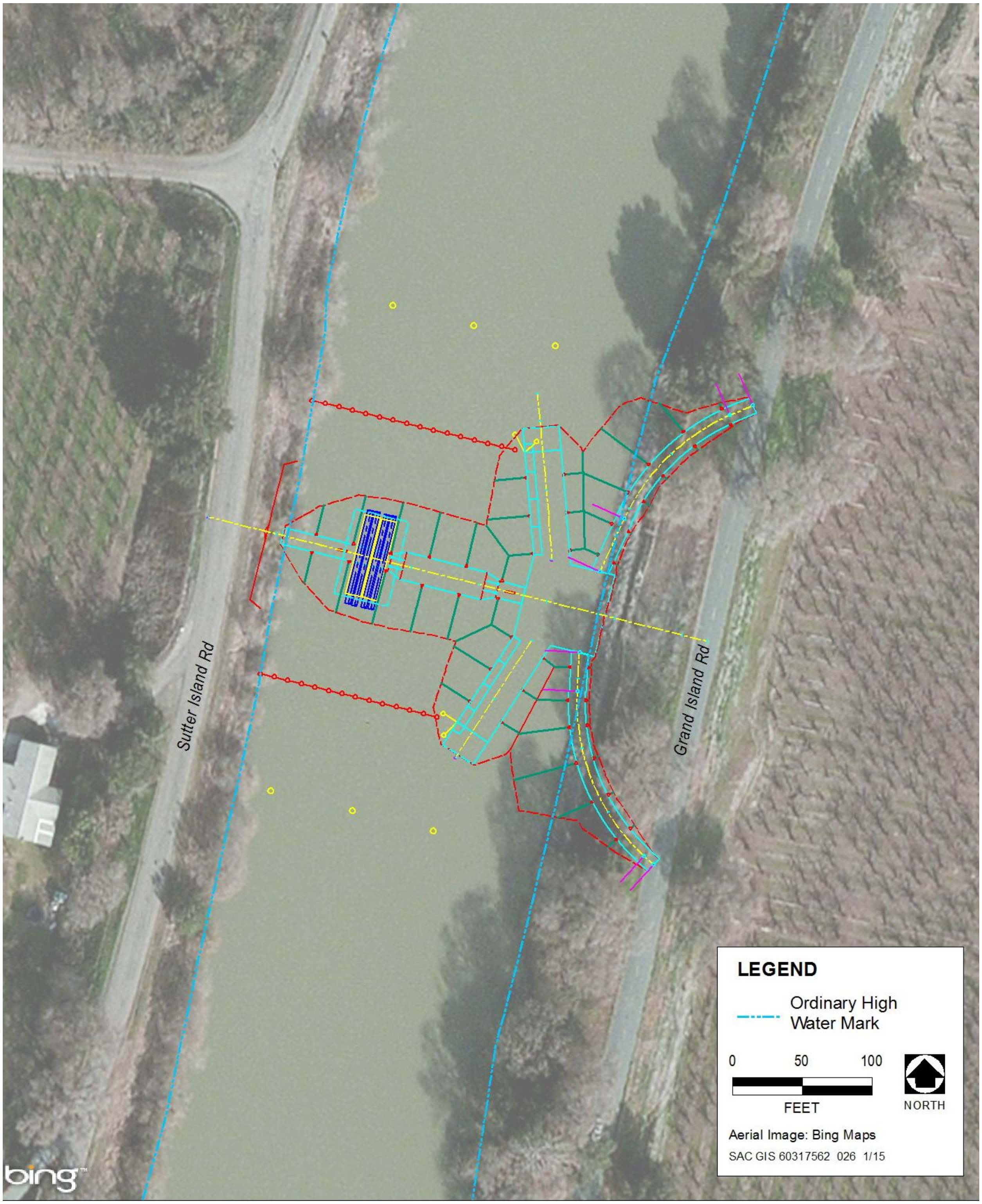
Source: Moffatt & Nichol 2014, AECOM 2014

Figure 2. Aerial View of Locations of Proposed Emergency Drought Barriers



Source: Moffatt & Nichol 2014, AECOM 2014

Figure 3. Project Site – Sutter Slough



Source: Moffatt & Nichol 2014, AECOM 2014

Figure 4. Project Site – Steamboat Slough

Source: Moffatt & Nichol 2014, AECOM 2014

Figure 5. Project Site – West False River

Figure 6. Project Site – Sutter Slough East Levee (top) and West Levee (bottom)

Figure 7. Project Site – Steamboat Slough East Levee (top) and West Levee (bottom)

Figure 8. Project Site – West False River South Levee (top), North Levee (middle), and North Levee at USGS Gaging Station East of the Barrier Site (bottom)

The Sutter Slough site is located in the North Delta about 0.6 mile directly west of the Sacramento River at the northwest end of Sutter Island. This site is approximately 1 mile southwest of the community of Courtland and 7 miles northwest of Walnut Grove and is on the border between Yolo and Sacramento counties. The barrier site is located about 1.25 miles downstream from the confluence of Sutter Slough and the Sacramento River. The banks of Sutter Slough where the barrier would be placed vary (Figure 6). The east levee has a rock-lined shoreline with woody and herbaceous vegetation on the levee slope. The west levee is not rock-lined and has mature woody riparian and upland vegetation and herbaceous vegetation.

The Steamboat Slough site is approximately 2.1 miles south-southeast of the Sutter Slough site, on the east side of Sutter Island, and approximately 1 mile southwest of the Sacramento River in Sacramento County. The Steamboat Slough barrier site is located about 1 mile downstream from the confluence of Steamboat Slough and the Sacramento River and is between Sutter and Grand Islands. The banks of Steamboat Slough where the barrier would be placed are largely rock-lined levees (Figure 7).

The West False River site is located approximately 0.4 mile east of the confluence with the San Joaquin River, between Jersey and Bradford Islands in Contra Costa County, and is about 4.8 miles northeast of Oakley. The banks of the West False River site are rock-lined levees (Figure 8).

3.4 Geologic Exploration

Geologic exploration would potentially occur in any year from 2015 to 2025 that the EDB would not be installed. A total of 12 cone penetrometer tests (CPTs), six drill holes, and three overwater drill holes would be completed.

3.4.1 Cone Penetrometer Test Soundings

Two CPT soundings would be conducted on each side of the channel at each site, one on the crown and one at the landside toe of the levee. The crown CPTs would be approximately 100 feet deep, and the toe CPTs would be approximately 70 feet deep. The CPT soundings are anticipated to be completed within approximately 2-3 days at each site and to be abandoned by backfilling the boreholes using cement/bentonite grout through a tremie pipe.

3.4.2 Land Drill Holes

At each site, a hollow stem auger (HSA)/mud rotary drill hole would be drilled through the levee crown on each side of the channel, to a depth of approximately 100 feet. The drill holes would be advanced by a truck-mounted rotary drill rig, accompanied by a drill rig tender/tool truck. Eight-inch-diameter HSAs would be used; the augers may be removed and replaced with casing or left in place to act as casing to protect the embankment during mud rotary drilling. In this case, the term “mud” refers to the use of bentonite clay added to the boring to allow removal of drill cuttings and to stabilize the drill hole.

Standard penetration tests with a 140-pound autohammer would be conducted a minimum of every 5 feet during drilling, and the cleanout interval would be continuously cored using a geo-barrel or equivalent continuous soil coring method. Based on CPT findings, fine-grained soils would be sampled using thin-walled samplers such as Shelby tube, Pitcher barrel, or piston, depending on the consistency of the soil. Drill cuttings and drilling fluid would be contained in drums, large containers, or vacuum truck and disposed of at an appropriate landfill. The two drill holes are anticipated to be completed in approximately 3 days at each site and to be abandoned using the same method described above for the CPT soundings.

3.4.3 Optional Overwater Explorations

One overwater geotechnical drill hole may be completed in the channel at each site to a planned depth of approximately 80 feet below the mud line (river bottom). If overwater exploration is conducted, it would occur between August 1 and November 30, to minimize the potential for adverse effects on fish and other aquatic resources. The drilling would be conducted with a rotary drilling rig mounted on a shallow-draft barge anchored into the bottom of the channel with two to four spuds (steel pipes). Personnel would access the barge via a support boat from an established marina. When a drill rig remains on a boring location for more than 1 day, the drill apparatus and casing would remain in the water column and drill hole to minimize sediment disturbance of the river bottom.

The drill apparatus would consist of a 6- to 8-inch-diameter conductor casing that would extend from the barge deck, through the water column, and into the soft sediments of the river bottom. The casing would be smaller than most piers and would not impede water flow. All of the drilling rods, samplers, and other down-hole equipment would pass through the inside of the casing, which would separate them effectively from the water.

The drill hole would be advanced using mud rotary method and would be drilled and sampled to a maximum depth of approximately 80 feet below the mud line. Initially, the boring would be advanced by pushing the conductor casing to approximately 10 feet or more below the mud line. The conductor casing would be used to confine the drill fluid and cuttings within the drill hole and operating deck of the barge and prevent any inadvertent spillage into the water. Soil samples would be collected from within the conductor casing using the same methods described above for the land drill holes.

The drill hole below the conductor casing would be approximately 3.5 to 5.5 inches in diameter. Only water would be circulated through the pumps and conductor casing when drilling and sampling within 15-20 feet of the mud line. For drilling deeper than 15-20 feet, the drilling fluid, consisting of a mixture of circulating water and bentonite clay, would be introduced into the conductor casing via the drill string to create a more viscous drilling fluid (drilling mud). The drilling fluid would pass down the center of the drill rod to the cutting face in the formation being drilled and would return up the drilled hole with the suspended cuttings. The drilling fluids and cuttings would be confined by the borehole walls and the conductor casing. Return drill fluids would pass through the conductor casing to the barge and then through a tee connection or similar device at the head of the conductor casing into the drilling fluid recirculation tank.

The conductor casing and the recirculation tank would create a closed system at the top of the hole on the barge deck to contain the drill fluids. A heavy plastic sleeve would be placed over the conductor casing and would drape into an external mud tank to reduce drilling fluid leaks between the casing and the barge deck. This system would provide a reliable seal and prevent significant spillage of the drilling fluid into the water. The drill rod and sample rod connections would be disconnected either directly over the conductor casing or the recirculation tank. Furthermore, positive barriers consisting of straw wattles and/or other suitable types of spill-stoppage materials would be placed around the work area on the barge. Drill cuttings (sand) that settle out in the recirculation tank would be collected into 55-gallon storage drums. Good work practices would be observed and maintained in containing the drilling fluid, including taking care when transferring drill cuttings from the recirculation tank to the drums. The drums would be placed adjacent to the recirculation tank. If drilling fluid or drill cuttings material accidently spill onto the barge deck outside of the containment area, they would be picked up immediately with a flat blade shovel and placed either into the recirculation tank or a storage drum, and the affected area would be cleaned. Discarded soil samples also would be placed in the storage drums.

An engineering geologist would be onsite at the drill rig to supervise activities at all times during the operation to ensure that all drilling fluid and cuttings are kept and confined within the recirculation tanks and storage drums. The engineering geologist would pay special attention to the river water for the presence of colored or increasingly opaque plumes when drilling, grouting, and pulling the conductor casing. Colored plumes are an indication that material may be leaking into the water. All personnel on the barge would report any observations of colored plumes in the water or leaking of the drilling fluids to the engineering geologist. If an unauthorized discharge is discovered by any of the personnel on board the barge, drilling activities would cease until appropriate corrective measures are completed. Cuttings and excess drilling fluid would be contained in drums or bins, periodically off-loaded to a land-based staging area, and disposed at a State-approved landfill site. The overwater borings would take place a maximum 200 feet from each of the proposed barrier locations and would be performed by a licensed drilling contractor under the direction of DWR or its contractor. The overwater drilling is anticipated to be completed in approximately 3 days at each site.

3.5 General Design and Installation Concepts

Rock (rip-rap) barrier weir structures would be installed at three sites (i.e., Sutter Slough, Steamboat Slough, and West False River) between 2015 and 2025. During this 10-year period, the barriers could be installed up to three times, including potentially in consecutive years. All structures would be trapezoid-shaped rock barriers with a wide base tapering up to a 12-foot-wide top width set perpendicular to the channel alignment. Rock fill would be placed along the base of the levees for support at the Sutter and Steamboat Slough sites. The West False River site would have transitions to the levees with 75-foot-long sheet pile walls supported by king piles and buttressed with rock because the levees are weaker in this area than at the northerly sites due to peat soil foundations.

Construction of the barriers may include land-based staging of equipment and materials. Before the start of construction, DWR would work with adjacent property owners at the Sutter Slough and Steamboat Slough sites to obtain temporary rights to access parcels for barrier installation up to three times in a 10-year period, including potentially in consecutive years. This applies to the following Assessor Parcel Numbers (APNs):

- APN 142-0010-002-0000 (Sutter Slough Site, Sacramento County)
- APN 043-030-006-000 (Sutter Slough Site, Yolo County)
- APN 142-0020-056-0000 (Steamboat Slough Site, Sacramento County
- APN 142-0030-016-0000 (Steamboat Slough Site, Sacramento County)

Temporary rights for construction of the West False River barrier may be obtained before securing the necessary permanent easement rights required for those portions of the piping preventers, sheet pile walls, king piles, and rock abutments that would be permanent installations. This applies to the following APNs:

- APN 027-010-005-0 (West False River Site, Contra Costa County)
- APN 026-040-005-6 (West False River Site Contra Costa County)

Temporary access rights for construction inspection and fence installation purposes will be required from the following APNs on Bradford Island:

- APN 026-040-003-1 (West False River Site, Contra Costa County)
- APN 026-050-006-1 (West False River Site, Contra Costa County)
- APN 026-050-018-6 (West False River Site, Contra Costa County)
- APN 026-050-024-4 (West False River Site, Contra Costa County)

The rock barriers may be installed at each of the sites in spring or summer, beginning no sooner than May 7 at the West False River location, and May 22 at the Sutter and Steamboat Slough sites. The construction period would be approximately 30 to 60 days. Barrier removal may require approximately 30 to 60 days for Sutter and Steamboat sloughs with removal commencing on or near October 1 and approximately 45 to 60 days for West False River with removal also commencing on or near October 1. The barriers would be removed entirely no later than November 1 for Sutter and Steamboat sloughs and November 15 for West False River, before the rainy season when freshwater runoff typically occurs and flood risk increases.

The Sutter and Steamboat Slough sites would be designed to allow fish passage (primarily for Chinook salmon, steelhead, green sturgeon, and white sturgeon) and manage water quality on the downstream side of the barriers using a combination of a an overflow weir designed to be inundated in the event of a very high tide or high river discharge and the installation of four 48-inch culverts with slide gates. The West False River barrier does not include these features. Tidal flows would be the main factor influencing water quality conditions at the West False River barrier. Fish movement can occur through the adjacent San Joaquin River and through other channels, including Fisherman's Cut, East False River, and Dutch Slough during the West False River closure.

Vessel traffic would be blocked at each barrier site. Boat ramps would be provided on either side of the Steamboat Slough barrier. Vessels up to 24 feet and 10,000 pounds would be moved around the barrier by equipment and an operator provided by the State. Boats heading into Sutter Slough would be directed by signage to Steamboat Slough for passage. Larger vessels would need to transit the Sacramento River channel instead of passing through Sutter or Steamboat sloughs between Courtland and Rio Vista. Boat access would not be provided at the West False River site because alternative routes are available via the Stockton Deep Water Ship Channel in the San Joaquin River between Antioch and eastern Delta locations, or via Fisherman's Cut or East False River to South Delta destinations.

Solar-powered monitoring instruments would be placed at appropriate locations upstream and downstream at each site and would monitor parameters like dissolved oxygen, turbidity, salinity as measured by electrical conductivity (EC), river stage, and flow velocity. Additional monitoring, including the use of DIDSON cameras, would be used to assess the Sutter and Steamboat Slough sites for interaction with and passage of migratory fish through the culverts. One 48-inch culvert would remain fully open at all times at the Sutter and Steamboat Slough barriers primarily for fish passage.

Appropriate navigation signage would be installed at each of the sites and would comply with navigation requirements established by the U.S. Aids to Navigation System and the California Waterway Marker system, as appropriate. Signs would be posted at upstream and downstream entrances to each waterway or other key locations, informing boaters of the restricted access. A Notice to Mariners would include information on the location, date, and duration of channel closures. Signs would be posted on each side of each barrier, float lines with orange ball floats would be located across the width of the channels to deter boaters from approaching the barriers, and solar-powered warning buoys with flashing lights would be present on the barrier crest to prevent accidents during nighttime hours. Additional information regarding navigational issues at each of the sites is provided in section 3.6 *Structural Components*.

3.6 Structural Components

3.6.1 Sutter Slough Site

The Sutter Slough rock barrier (Figure 3) would be 200 feet long and up to143 feet wide at the base and 12 feet wide at the top. The top of the barrier would be set at an elevation of 9.5 feet across the crest and would include about a 50-foot overflow weir 20 feet wide at the top, set at 7.5 feet elevation.[1] The weir would allow overflows at high stage, keep flow in the middle of the channel, and minimize the potential for erosion of the river banks. The barrier would include a submerged structure placed on a bed of crushed rock consisting of two steel frames with four 48-inch diameter corrugated metal culverts, approximately 60 feet long, set at an invert elevation of approximately -4 feet. The culverts would be operated to allow fish passage and to regulate water levels and water quality on the downstream side of the barrier. One culvert would remain fully open at all times for fish passage, and the other culvert slide gates would be operated such that the culverts are fully open, fully closed, or at least 50 percent open as needed to improve water quality and/or stage downstream of the barriers.

The monitoring equipment and operable culverts would be accessed by the levee road on the north or via State Route 145. The site is navigable and is used primarily by recreational traffic, but signs would be posted at both entrances to the slough, informing boaters that Steamboat Slough provides boat passage for vessels up to 24 feet long and up to 10,000 pounds.

3.6.2 Steamboat Slough Site

The Steamboat Slough rock barrier would be 220 feet long, up to 110 wide at the base, and 12 feet wide at the top (Figure 4). The top of the structure would be at elevation 9.5 feet and would include about a 60-foot overflow weir 20 feet wide at the top, set at 7.5 feet, and is designed to operate similar to the weir in Sutter Slough. Like the Sutter Slough site, it would include a submerged steel frame set at an invert elevation of -4 feet with four 48-inch corrugated metal culverts, approximately 60 feet long, to allow fish passage and management of downstream water surface elevation and quality. One culvert would remain fully open at all times for fish passage, and the other culvert slide gates would be operated such that the culverts are fully open, fully closed, or at least 50 percent open as needed to improve water quality, stage downstream of the barriers, and/or fish passage.

This site is navigable by commercial and recreational traffic, and boat ramps on each side of the barrier would be provided on the east side of the channel. Two new 12-foot-wide gravel roads

[1] Vertical elevations are based on the North American Vertical Datum of 1988 (NAVD 88).

would connect to Grand Island Road. The south access road would be about 180 feet long, and the north access road would be about 200 feet long. A State-provided boat tender would be present on the apron during daytime hours with a pickup truck and trailer. When a boat approaches, the trailer would be backed into the water, the boat would be placed on the trailer, and it would be driven to the boat ramp on the other side, where it would be placed back in the river. Boats up to 24 feet and 10,000 pounds could be accommodated. The site would not be available for launching boats from the land. The ramps would be approximately 22 feet wide and would be placed on rock fill with a 15 percent slope. The south ramp would be approximately 90 feet long, and the north ramp would be approximately 120 feet long. Dock anchors (comparable to mooring lines) would be used to stabilize the boat ramps. Bollards and a chain would be installed to restrict access to the boat ramp from the public road.

Workers would access the boat ramps via Grand Island Road, and the monitoring equipment and operable slide gates would be accessed via Sutter Island Road, both of which are public roads, or by boat.

3.6.3 West False River Site

The West False River barrier would be approximately 800 feet long and up to 200 feet wide at the base, and 12 feet wide at the top (Figure 5). The toe fill would extend approximately 100 feet upstream and downstream of the barrier centerline. The top of the structure would be at an elevation of 7 feet across the entire crest. The barrier would include two king pile-supported sheet pile walls extending out from each levee into the channel for a distance of 75 feet. The sheet piles/king piles would be required because the levees are weaker at this location; they sit on peat, and placing a large volume of rock directly on the levees would cause too much stress. The walls would be buttressed with some rock on both sides, however. After barrier removal, rock would be used to make smooth transitions around the sheet pile abutments which would remain in place for possible future use. DWR would assure that this rock is maintained and either contract with the Local Maintaining Agency (LMA) or use DWR resources or contractors to repair and or replace the transition rock as needed. The annual inspection of the rock would compare actual conditions with as constructed plans and/or bathymetric survey data. The results of the inspections and any bathymetric survey data collected would be made available to the LMAs. Any necessary repairs of the rock would be made using land or water-based construction equipment during summer and fall (July through October) when special-status species are less likely to be affected.

The piles to be installed at West False River site would include in total:

- Eight 36-inch-diameter king piles (barrier abutments)
- About 70 sheet piles (barrier abutments), or about 35 pairs of sheet piles totaling approximately 160 wall feet (including approximately 5 feet on either side that would be in the levee)
- Four 24-inch steel pipe piles (float line attachment, i.e., two piles upstream and downstream of the barrier)
- Four 12-inch steel pipe piles (monitoring equipment)

In addition to river sheet piles, approximately 300 feet of sheet piles would be installed parallel to the channel to prevent water piping from the river through the levee to a depth of approximately 35 feet. These piping preventer sheet piles would be set into the tops of the levees on each side of the barrier and would remain in place for possible future use.

No boat passage is provided around this barrier because alternative routes (Fisherman's Cut or False River east for vessel traffic between the South Delta to the San Joaquin River and the Main San Joaquin River for vessel traffic between the Antioch and the eastern Delta) are available. No fish passage has been provided because migrating fish would use the adjacent San Joaquin River, Fisherman's Cut, or Dutch Slough and their access would not be restricted.

To monitor water quality in the Central Delta and the associated changes in water quality and flow resulting from the West False River barrier, DWR proposes to install up to four water quality monitoring and/or flow monitoring stations at Fisherman's Cut (approximately 1.5 miles east of the barrier), Franks Tract, and potentially two additional sites. The stations, which would be able to monitor EC, turbidity, dissolved oxygen, chlorophyll, nutrients, bromide, and organic carbons would be installed on 12-inch-diameter steel pipe piles. DWR would place navigational aids as needed at the stations.

3.7 Project Construction

3.7.1 Construction Practices

Notices of construction would be posted at local marinas and in the Local Notice to Mariners. Navigational markers would be used to prevent boaters from entering the immediate construction area, and speed limits would be posted. Safe vessel passage procedures would be coordinated with the U.S. Coast Guard District 11 and California Department of Parks and Recreation Division of Boating and Waterways (Cal Boating). An educational program would be implemented to inform boaters of the purpose of the proposed project and the expected duration of installation activities. The program would include notices in local newspapers and boater publications as appropriate; notices also would be posted at local marinas and boat launches and on the proposed project website.

Approximately 116,000 cubic yards of rock would be required to construct the barriers, which would include approximately 12,000 cubic yards at the Sutter Slough site, approximately 11,500 cubic yards at the Steamboat Slough site, and approximately 92,500 cubic yards at the West False River site (including approximately 21,000 cubic yards that would remain around the West False River sheet piles and on the adjacent levee). Clean, unwashed rock would be used. The rock source would likely be one or more existing quarries, near San Rafael. Structures such as the steel frames used to support culverts that allow fish passage and articulated concrete mats for boat ramps would be prefabricated. Most materials and construction equipment (e.g., cranes and clamshells and the vibratory pile driver used at the West False River site) would be brought to the site by barges, and most construction would take place from the water. The exceptions would be construction of the gravel roads used to access the boat ramps at Steamboat Slough, the transport of road materials and boat ramps to this site, and perhaps the installation of portions of the king piles and sheet piles at the West False River site. In addition, minimal vegetation and clearing would be required on the levees prior to placement of rock or the installation of sheet piles. This would be accomplished by a dozer or backhoe and hand clearing. The gravel access roads at the Steamboat Slough site also would be cleared and grubbed of trees and other vegetation, which would be hauled off-site and disposed of in an appropriate location. The terrestrial footprint would be about 0.003 acre at the Sutter Slough site, and about 0.212 acre at the Steamboat Slough site (includes roads and ramps). The extent of clearing and grubbing would likely be more restricted, and would depend on existing vegetation and maneuvering of construction equipment. The east Steamboat Slough levee, where the access roads and boat ramps would be installed, is mostly a rock-lined levee with almost no vegetation on the levee face, with some herbaceous vegetation and a few trees on the levee top.

Any levee access roads that are damaged as a result of construction equipment or truck use would be restored to pre-construction conditions or better after construction is completed.

The rock barriers would be constructed using a barge-mounted crane and clamshell to place the rock in the channel at the Sutter and Steamboat Slough sites. Because of the greater width of the channel at the West False River site, a dump scow may be used to transport the rock and place it in the channel. Some rock placement at this site would require the use of a barge-mounted crane and bucket. Although some rock slope protection may need to be temporarily moved out of the sheet pile abutments alignments at False River, no channel dredging or excavation in the levee profiles would be required.

The sheet and king piles are anticipated to be installed by an appropriately-sized vibratory hammer, which appears to be feasible given the anticipated ground conditions and modest pile penetration of 20 feet to 50 feet in the ground. Vibratory penetration rates are normally limited to 20 inches per minute (per North American Sheet Piling Associations – Best Practices, www.nasspa.com), which would result in the following vibration times per pile assuming normal driving conditions:

- 20-foot ground penetration: 12 minutes
- 50-foot ground penetration: 30 minutes

Due to uncertainties of the ground conditions and the possibility of encountering dense soil layers and/or obstructions such as left-in-place rip-rap on the existing levee side slopes, a larger impact hammer would be available as a contingency measure, in the event unexpected difficult driving is encountered. The impact hammer would only be used if the vibratory hammer cannot reach design tip elevation of the pilings. In the absence of detailed geotechnical information, it is not known whether an impact hammer would be required, and the exact location and timing of its use. If piles are driven by impact hammers in water deeper than 3.3 feet, a bubble curtain would be employed if underwater noise exceeds pre-established levels (peak pressure levels or cumulative sound exposure level) that would indicate potential injury to fish.

A complete list of construction equipment anticipated to be used at the three sites is provided in Tables 2 through 4.

3.7.2 Construction Schedule

Construction would occur during regular daytime hours. Construction may occur concurrently at more than one project site, if adequate equipment is available.[2] The overall schedule for construction of the three barriers is estimated to be approximately 30 to 60 days. The barriers may be installed in spring or summer and removed in fall. Removal would take approximately 30 to 60 days. Construction would require approximately 10 to 30 workers.

[2] As described below in section 3.8 *Environmental Commitments*, potential phasing of construction/operations would be coordinated with the permitting fish agencies to meet the purpose of the EDB while minimizing effects to listed fishes.

Table 2. Sutter Slough Anticipated Construction Equipment

Type of Equipment	Maximum Number	Type of Equipment	Maximum Number	Type of Equipment	Maximum Number
Place Rock					
Tug/barge	4	Dozer	1	Rock haul/dump truck	4
Crane	1	Loader	4	Conveyor	3
Work boat	1				
Place Culverts					
Off-road fork lift	2	Air compressor	1	Off-road fork lift	1
Crane	1	Power generator	1	Skid steer loader	1
Pickup	3	Tug/barge	1	Service truck	1
Removal					
Tug/barge	4	Excavator	3	Front-end loader	2
Long reach excavator	2	Dump truck	4	Grader	1
Work boat	2	Dozer	1		

Table 3. Steamboat Slough Anticipated Construction Equipment

Type of Equipment	Maximum Number	Type of Equipment	Maximum Number	Type of Equipment	Maximum Number
Place Rock					
Tug/barge	4	Dozer	1	Rock haul/dump truck	4
Crane	1	Loader	4	Conveyor	3
Work boat	1				
Place Culverts					
Off-road fork lift	2	Power generator	1	Service truck	1
Crane	1	Tug/barge	1	Grader	1
Pickup	3	Off-road fork lift	1	Front-end loader	2
Air compressor	1	Skid steer loader	1	Work boat	1
Removal					
Tug/barge	4	Excavator	3	Front-end loader	2
Long reach excavator	2	Dump truck	4	Grader	1
Work boat	2	Dozer	1		

Table 4. West False River Anticipated Construction Equipment

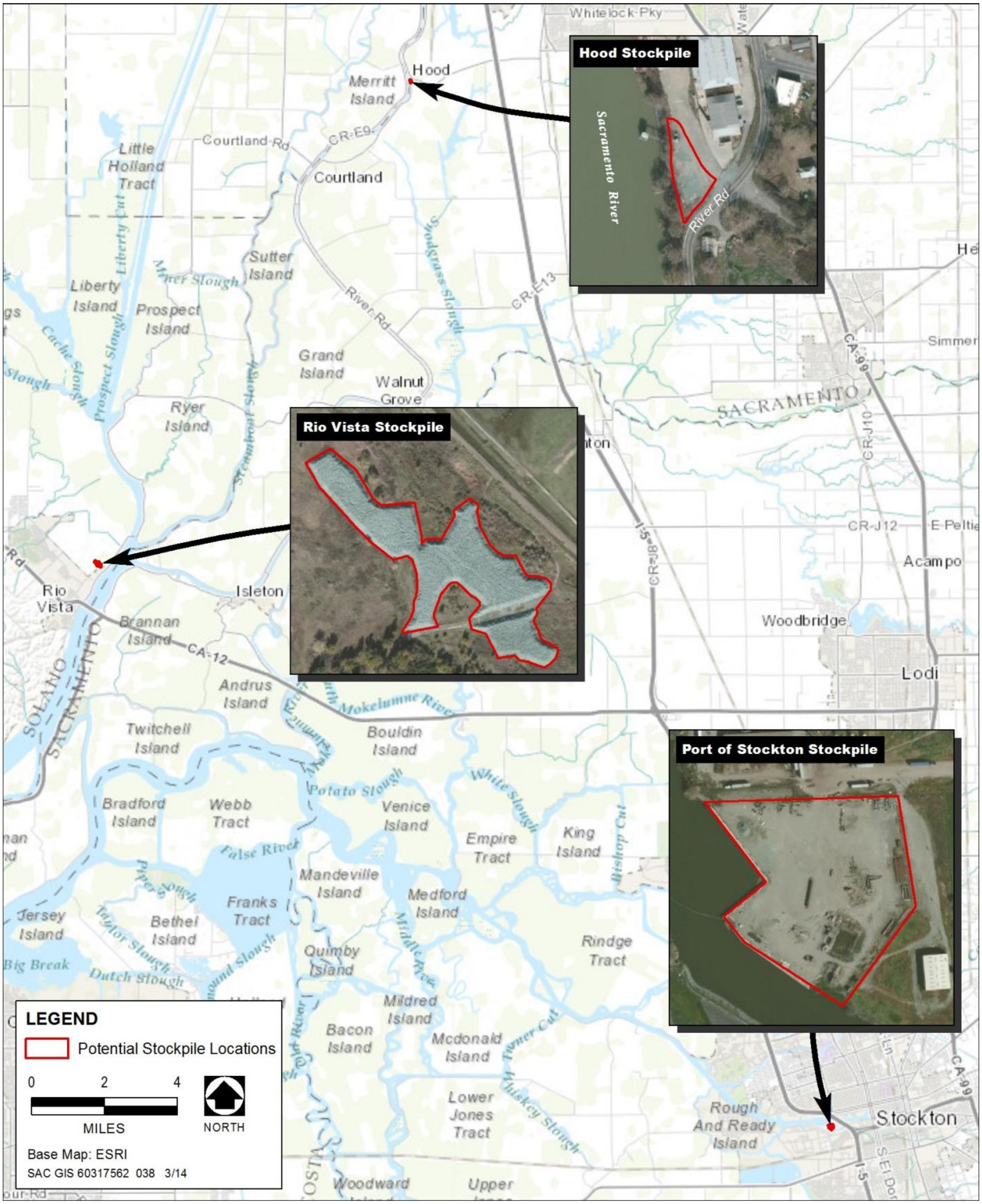
Type of Equipment	Maximum Number	Type of Equipment	Maximum Number	Type of Equipment	Maximum Number
Place Rock					
Tug/barge	8	Dozer	1	Rock haul/dump truck	4
Crane	2	Loader	4	Conveyor	3
Work boat	2				
Place Culverts					
Tug/barge	2	Skid steer loader	1	Crane	1
Crane	2	Off-road crane	1	Pickup	4
Work boat	2	Service truck	1	Air compressor	1
Grader	1	Off-road fork lift	2	Power generator	1
Compactor	1				
Removal					
Tug/barge	8	Excavator	3	Front-end loader	2
Long-reach excavator	3	Dump truck	4	Grader	1
Work boat	2	Dozer	1		

The following construction, operation, and removal dates are proposed for each barrier location:

- West False River barrier: in-water construction to begin no sooner than May 7, with full barrier closure on or near approximately 30 to 60 days after starting work; removal would take approximately 45 to 60 days, with full removal by November 15;
- Sutter Slough barrier: in-water construction to begin no sooner than May 22, with full barrier closure approximately 30 to 60 days after starting installation; removal would take approximately 30 to 60 days, with full removal by November 1; and
- Steamboat Slough barrier: in-water construction to begin no sooner than May 22, with full barrier closure approximately 30 to 60 days after starting installation and after full closure of the Sutter Slough barrier; removal would take approximately 30 to 60 days, with full removal by November 1.

3.7.3 Facilities Removal

All rock, gravel, and structures would be removed from the project sites in fall, with the exception of the sheet pile abutments at the West False River site. Bathymetric surveys would be completed after rock fill removal to confirm that the rock is removed. The materials would be transported from the area, primarily on barges. Materials would be stored at a nearby DWR storage facility, likely located in Hood, Rio Vista, or the Port of Stockton, based on capacity availability and permitting coverage at the storage facility. These potential material storage locations are depicted in Figure 9. If lease arrangements can later be made with local landowners near the barrier sites, rock may be stored close to the barrier sites for use in future drought conditions if needed.



Source: DWR adapted by AECOM 2014

Figure 9. Potential Stockpile Locations

3.7.4 Site Restoration

Disturbed areas would be restored after initial construction and after each time EDB are removed (potentially up to three times in 10 years, including potentially in consecutive years). The affected areas would be restored to pre-project conditions.

A restoration plan addressing each site would be developed, as required by applicable regulatory agencies, and would be completed before the start of construction. Restoration activities would be implemented following construction, as needed. The restoration plan would identify areas that would be restored and restoration methods. Seed mixes, schedules, success criteria, and success monitoring for restoration, as needed, of any adversely affected wetlands and riparian habitats would be identified. The restoration plan would be included in the contract specifications.

3.7.5 Project Operations and Maintenance

EDB operations essentially would be limited to opening or closing the culvert slide gates at the Sutter and Steamboat Slough sites as necessary for water quality or maintenance purposes. As described in section 3.8 *Environmental Commitments,* monitoring data from nearby data stations would be used to inform the need to open or close the culverts. DWR would inform the permitting fish agencies (CDFW, USFWS, and NMFS) if any major maintenance activities are required during the period of operation (estimated to be June through October).

A log of project operations and a summary report of monitoring activities would be provided to the permitting agencies following completion of operations, with notification of any change in culvert operations during the operation period.

Given the temporary nature of the EDB, maintenance would be minimal or nonexistent.

3.8 Environmental Commitments

DWR would implement a number of conservation measures as part of the proposed project to avoid and minimize potential effects on sensitive species and habitats. These include measures related to general construction practices and measures that focus specifically on sensitive biological resources.

3.8.1 Prepare and Implement an Erosion Control Plan

An Erosion Control Plan will be prepared before construction activities that will cause ground disturbance. Site-specific erosion-control, spill-prevention, sedimentation control, and runoff measures will be developed and implemented during construction activities as part of the plan to minimize the potential for erosion and sedimentation during barrier construction and removal.

If applicable, tightly woven fiber netting (mesh size less than 0.25 inch) or similar material will be used for erosion control and other purposes at the project sites to ensure wildlife does not become trapped or entangled in the erosion control material. Coconut coir matting is an acceptable erosion control material, but no plastic mono-filament matting will be used for erosion control. If feasible, the edge of the material will be buried in the ground to prevent wildlife from crawling underneath the material.

3.8.2 Prepare and Implement a Spill Prevention and Control Program

A spill prevention and control program will be prepared before the start of construction to minimize the potential for hazardous, toxic, or petroleum substances to be released into the project area during construction and operation. The program will be implemented during construction. In addition, DWR will place sand bags, biologs, or other containment features around the areas used for fueling or other uses of hazardous materials to ensure that these materials do not accidentally leak into the river. DWR will adhere to the standard construction best management practices described in the current California Department of Transportation Construction Site Best Management Practices Manual (California Department of Transportation 2003).

The spill prevention and control program will include procedures for mitigating potential spills caused by collision/stranding of vessel traffic with the barriers during their operation. Spill control materials will be kept at the Steamboat Slough barrier site and at additional DWR-owned locations in the Delta. All barriers will have clear signage with telephone contact details for DWR personnel as well as the Governor's Office of Emergency Services (CalOES) hazardous materials (HAZMAT) spill notifications contact number (1-800-852-7550).

3.8.3 Prepare and Implement a Hazardous Materials Management Program

A Hazardous Materials Management Program (HMMP) will be prepared and implemented to identify the hazardous materials to be used during construction; describe measures to prevent, control, and minimize the spillage of hazardous substances; describe transport, storage, and disposal procedures for these substances; and outline procedures to be followed in case of a spill of a hazardous material. The HMMP will require that hazardous and potentially hazardous substances stored onsite be kept in securely closed containers located away from drainage courses, storm drains, and areas where stormwater is allowed to infiltrate. It will also stipulate procedures to minimize hazard during onsite fueling and servicing of construction equipment. Finally, the HMMP will require that adjacent land users be notified immediately of any substantial spill or release.

3.8.4 Implement Bay Area Air Quality Management District and Sacramento Metropolitan Air Quality Management District Basic and Enhanced Construction Emission Control Practices to Reduce Fugitive Dust

The construction contractor will implement the following applicable basic and enhanced control measures recommended by the Bay Area Air Quality Management District (BAAQMD) to reduce construction-related fugitive dust during grading at the West False River site (BAAQMD 2010):

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) will be watered two times per day, as necessary to control fugitive dust.
- All haul trucks transporting soil, sand, or other loose material off-site will be covered.
- All visible mud or dirt track-out onto adjacent public roads will be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping will be prohibited.
- All vehicle speeds on unpaved roads will be limited to 15 miles per hour.

- All construction equipment will be maintained and properly tuned in accordance with manufacturer's specifications. All equipment will be checked by a certified mechanic and will be determined to be running in proper condition before operation.
- A publicly visible sign with the telephone number and person to contact at the lead agency (i.e., DWR) regarding dust complaints will be posted at the construction sites. The person identified as the contact will respond and take corrective action within 48 hours. The air district's phone number also will be visible, to ensure compliance with applicable regulations.
- Idling time of diesel-powered construction equipment will be no more than 5 minutes.

All contractors will be required to use equipment that meets the California Air Resources Board's most recent certification standard for off-road heavy-duty diesel engines.

The construction contractor will implement the following applicable basic and enhanced control measures recommended by the Sacramento Metropolitan Air Quality Management District (SMAQMD) to reduce construction-related fugitive dust during grading at the Sutter Slough and Steamboat Slough project sites (SMAQMD 2010):

- All exposed surfaces will be watered two times daily. Exposed surfaces include, but are not limited to soil piles, graded areas, unpaved parking areas, staging areas, and access roads.
- Haul trucks transporting soil, sand, or other loose material on the site will be covered or will maintain at least 2 feet of free board space on. Any haul trucks that will be traveling along freeways or major roadways will be covered.
- Wet power vacuum street sweepers will be used to remove any visible trackout mud or dirt onto adjacent public roads at least once per day. Use of dry power sweeping will be prohibited.
- Vehicle speeds will be limited on unpaved roads to 15 miles per hour.
- Idling time will be minimized either by shutting equipment off when not in use or by reducing the idling time to 5 minutes (as required by California Code of Regulations, Title 13, Sections 2449[d][3] and 2485). Clear signage that posts this requirement for construction workers will be provided at the entrances to the sites.
- All construction equipment will be maintained in proper working condition according to manufacturer's specifications. The equipment will be checked by a certified mechanic and will be determined to be running in proper condition before it is operated.

In addition, the construction contractor will implement the following applicable enhanced measure to reduce operation-related diesel particulate matter:

- Acceptable options for reducing emissions may include use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and other options as they become available.

3.8.5 Reduce Construction-Related Emissions from Off-Road Equipment and Heavy-Duty Vehicles

The following measure from the BAAQMD's Additional Construction Mitigation Measures will be implemented during construction at the West False River project site (BAAQMD 2010a):

- All contractors will be required to use equipment that meet California Air Resources Board's most recent certification standard for off-road heavy duty diesel engines.

3.8.6 Fuel Tugboats/Barges with Renewable Diesel Fuel

All tugboats/barges will be fueled using renewable diesel fuel. The fuel provider could include, but is not limited to Golden Gate Petroleum. However, all renewable diesel fuel used from other providers will achieve a similar emissions reduction potential to Golden Gate Petroleum renewable diesel. In the case that renewable diesel cannot be used for tugboats/barges for logistic reasons, this will be recorded in the bi-weekly construction reports and incorporated into the final emissions and mitigation fee calculations.

3.8.7 Use Construction Monitoring and BAAQMD Carl Moyer Program or Another Verifiable Offset Program to Offset Regional Off-Site Emissions

DWR and/or its contractor will monitor construction activities throughout development of all three emergency drought barriers. Construction activities data will be collected, emissions associated with construction activities will be calculated, and these data will be reported to BAAQMD. The specifics of construction monitoring and reporting will be determined in consultation with BAAQMD. Construction activities data will include, but are not limited to the following items:

1) Tugboats/Barges
    - Distance traveled by tugboats/barges separated by “loaded” travel and “unloaded” travel
    - Horsepower of tugboats and auxiliary engines
    - Idling time of tugboats/barges
    - Fuel use and fuel type
2) Construction Equipment
    - Equipment type and number of pieces
    - Horsepower
    - Hours of actual operation
3) Haul Trucks (heavy-duty trucks)
    - Number of heavy-duty haul truck trips
    - Total trip distance for haul truck trips
4) Construction Workers
    - Number of construction workers per day

BAAQMD will collect the construction activity and emissions reports for record keeping and monitoring purposes. Following completion (i.e., removal of emergency drought barriers) of the proposed project, the final construction emissions will be evaluated to calculate the total offset mitigation fee based on actual construction activities. DWR will work in coordination with BAAQMD to assess the specific mechanisms associated with construction monitoring, emission calculations, and payment logistics.

DWR will use BAAQMD's Carl Moyer Program (CMP) or another verifiable program to offset the proposed project's reactive organic gases, oxides of nitrogen (NO_X), and particulate matter emissions that exceed the BAAQMD 2010 threshold as determined through the construction monitoring program described above. DWR may achieve the required offset through any combination of the following:

- Reduce on-site emission sources and implement offset actions (i.e., construction or operational changes to site-specific emissions).
- Implement offset emissions and programs available within Contra Costa County and the San Francisco Bay Area Air Basin (SFBAAB).
- Submit payment to BAAQMD on a per ton of NO_X amount (i.e., dollars per ton of NO_X to offset) for emission reduction projects that will be funded by BAAQMD. The price of NO_X emission offsets will be determined by BAAQMD on an annual basis. The types of projects that will be funded by BAAQMD can include:
    - Projects within the Contra Costa County and/or the SFBAAB that are eligible for funding under the CMP guidelines, which are real, surplus, quantifiable, and enforceable.
    - Projects to replace older, high-emitting construction equipment operating in Contra Costa County and/or the SFBAAB with newer, cleaner, retrofitted, or more efficient equipment.

3.8.8 Use Construction Monitoring and SMAQMD's Mitigation Fee to Offset Regional Off-Site Emissions

DWR and/or its contractor will monitor construction activities throughout development of all three emergency drought barriers. Construction activities data will be collected, emissions associated with construction activities will be calculated, and these data will be reported to SMAQMD. The specifics of construction monitoring and reporting will be determined in consultation with SMAQMD. Construction activities data will include, but are not limited to the following items:

1) Tugboats/Barges
    - Distance traveled by tugboats/barges separated by "loaded" travel and "unloaded" travel
    - Horsepower of tugboats and auxiliary engines
    - Idling time of tugboats/barges
    - Fuel use and fuel type
2) Construction Equipment
    - Equipment type and number of pieces
    - Horsepower
    - Hours of actual operation
3) Haul Trucks (heavy-duty trucks)
    - Number of heavy-duty haul truck trips
    - Total trip distance for haul truck trips

4) Construction Workers
    - Number of construction workers per day

SMAQMD will collect the construction activity and emissions reports for record keeping and monitoring purposes. Following completion (i.e., removal of emergency drought barriers) of the proposed project, the final construction emissions will be evaluated to calculate the total offset mitigation fee based on actual construction activities. DWR will work in coordination with SMAQMD to assess the specific mechanisms associated with construction monitoring, emission calculations, and payment logistics.

3.8.9 Conform to Best Management Practices (BMPs) for Construction and Maintenance Activities to Reduce Greenhouse Gas Emissions that are Contained in the Climate Action Plan Phase I: Greenhouse Gas Emissions Reduction Plan Implementation Procedures (DWR 2012)

3.8.9.1 Pre-Construction and Final Design BMPs

- Evaluate project characteristics, including location, project work flow, site conditions, and equipment performance requirements, to determine whether specifications of the use of equipment with repowered engines, electric drive trains, or other high efficiency technologies are appropriate and feasible for the project or specific elements of the proposed project.
- Evaluate the feasibility and efficacy of performing on-site material hauling with trucks equipped with on-road engines.
- Ensure that all feasible avenues have been explored for providing an electrical service drop to the construction site for temporary construction power. When generators must be used, use alternative fuels, such as propane or solar, to power generators to the maximum extent feasible.
- Limit deliveries of materials and equipment to the site to off-peak traffic congestion hours.

3.8.9.2 Construction BMPs

- Minimize idling time by requiring that construction equipment be shut down after 5 minutes when not in use, as required by the State airborne toxics control measure in Section 2485 of Title 13 in the California Code of Regulations. Provide clear signage that posts this requirement for construction workers at the entrances to construction sites and provide a plan for the enforcement of this requirement.
- Maintain all construction equipment in proper working condition and perform all preventative maintenance. Required maintenance will include compliance with all manufacturer's recommendations, proper upkeep and replacement of filters and mufflers, and maintenance of all engine and emissions systems in proper operating condition.
- Implement a tire inflation program at construction sites to ensure that equipment tires are correctly inflated. Check tire inflation when equipment arrives on-site and every 2 weeks for equipment that remains on-site. Check vehicles used for hauling materials off-site weekly for correct tire inflation.

- Develop a project-specific ride share program to encourage carpools, shuttle vans, transit passes, and/or secure bicycle parking for construction worker commutes.
- Reduce electricity use in temporary construction offices by using high efficiency lighting and requiring that heating and cooling units be Energy Star compliant. Require that all contractors develop and implement procedures for turning off computers, lights, air conditioners, heaters, and other equipment each day at close of business.
- For deliveries to construction sites where the haul distance exceeds 100 miles and a heavy-duty class 7 or class 8 semi-truck or 53-foot or longer box-type trailer is used for hauling, a SmartWay2 certified truck will be used to the maximum extent feasible.
- Develop a project-specific construction debris recycling and diversion program to achieve a documented 50 percent diversion of construction waste.
- Evaluate the feasibility of restricting all material hauling on public roadways to off-peak traffic congestion hours. During construction scheduling and execution, minimize, to the extent possible, uses of public roadways that will increase traffic congestion.

3.8.10 Conduct a Worker Environmental Awareness Program

Construction workers will participate in a worker environmental awareness program that addresses species under jurisdiction of the permitting agencies (CDFW, USFWS, and NMFS). Workers will be informed about the potential presence of listed and other protected species, and habitats associated with such species, and that unlawful take of the species or destruction of their habitat is a violation of the Federal Endangered Species Act, CESA, and/or Migratory Bird Treaty Act. Before the start of construction activities, a qualified biologist approved by the permitting agencies will instruct all construction workers about the life histories of the protected species and the terms and conditions of the EDB Biological Opinions (BOs), CESA ITP, and other regulatory permits that include biological resource protection measures. Proof of this instruction will be submitted to the permitting agencies.

3.8.11 Conduct Biological Monitoring

A qualified biologist approved by the permitting agencies will be onsite daily to conduct compliance inspections and monitor all in-water construction activities. The qualifications of the biologist(s) will be presented to the permitting agencies for review and written approval at least 10 working days prior to project activities at the project sites. Prior to approval, the biologist(s) will submit a letter to the permitting agencies that states that they understand the terms and conditions of the permitting documents (BOs, CESA ITP). The biologist(s) will keep a copy of the permitting documents in their possession when onsite. The biologist(s) will be given the authority to stop work that may result in, or in the event that there is, take of listed species in excess of limits provided by the permitting agencies in any permitting documents (BOs, CESA ITP). If the biologist(s) exercise(s) this authority, the permitting agencies will be notified by telephone and electronic mail within 1 working day.

A report of daily records from monitoring activities and observations will be prepared and provided to the permitting agencies upon completion of project activities.

3.8.12 Conduct Real-Time Monitoring and Adjust Construction Activities Accordingly

DWR will monitor weather patterns and river forecasts for the period preceding the start of construction. If precipitation events or increases in river levels and flows are predicted to occur immediately before the start of construction, DWR will notify NMFS, USFWS, and CDFW before the start of construction and informally will confer with them to determine whether construction actions are still feasible as previously considered. Sudden increases in river flows, imminent precipitation events that create changes in river stage in the Sacramento and San Joaquin valleys, or observed sudden increases in turbidity in the Sacramento or San Joaquin rivers upstream of the Delta may initiate pulses of fish migration into the project channels (e.g., juvenile salmonids moving downstream, pre-spawning delta smelt moving upstream).

DWR also will monitor the capture of listed fishes in the fish monitoring programs currently being employed in and close to the barrier sites, i.e., Sacramento area beach seines and trawling (Sherwood Harbor and Jersey Point) by USFWS; and Knights Landing and Tisdale Weir rotary screw traps (RSTs), 20-millimeter (mm) survey, Spring Kodiak Trawl, and fish salvage monitoring by CDFW. If increasing presence of listed fishes (principally juvenile salmonids and smelts) is detected in these monitoring efforts during project implementation, DWR will immediately contact NMFS, USFWS, and CDFW to allow informal consultation to determine whether construction actions will place fish at substantial additional risk near the barrier sites.

3.8.13 Phase Barrier Construction, Operation, and Removal In Collaboration With Permitting Fish Agencies and In Consideration of Real-Time Monitoring Data

DWR will collaborate with the permitting fish agencies to develop and implement if necessary a phased construction and operation plan intended to fulfill the main purpose of the proposed project (i.e., to prevent excessive salinity intrusion into the Delta and conserve water in reservoirs) while minimizing adverse potential effects on listed fishes. The plan would be developed in consideration of the latest real-time monitoring data to assess the temporal and spatial distribution of listed fishes that could be affected by project operations.

3.8.14 Facilitate Upstream Barrier Passage for Adult Anadromous Fishes (Culvert Opening and Slopes Leading to Culverts) and Monitor Effectiveness

DWR will facilitate upstream passage of adult anadromous fishes (Chinook salmon, steelhead, and sturgeon) at the Sutter and Steamboat Slough barriers by keeping a single culvert at each barrier open at all times. To increase the probability of sturgeon locating the culvert openings, DWR will provide a 4-foot pad in front of the downstream culvert mouths and a 2:1 slope from the pad to the channel bed. These slopes would be provided on the downstream sides of both barriers to facilitate passage.

Passage success of adult anadromous fishes approaching the barrier will be assessed with DIDSON monitoring. Additional culverts will be opened as necessary should special-status fish congregate below the barriers as identified from monitoring observations. Additional culverts will be opened only when existing open culverts are fully open, and the minimum opening for any culvert will be 50 percent.

3.8.15 Implement Adaptive Management Program

DWR will adaptively manage the EDB in coordination with USFWS, NMFS, and CDFW on a weekly call during the construction, operation and removal of the barriers. Adaptive management will include reviewing first-year project monitoring reports with USFWS, NMFS, and CDFW identifying apparent problem areas; formulating potential solutions, and refining project elements for future-year implementation based on the best available solutions to address any identified problems. The success of these solutions would be monitored in the subsequent year of implementation, with the adaptive management cycle beginning again to allow correction of any further problems that were identified. Specific adaptive management measures would be identified during the process described above.

3.8.16 Conduct Pile Driving With a Vibratory Driver To The Extent Possible; Minimize Effects of Impact Driving

DWR will conduct pile driving using a vibratory hammer to minimize to the extent possible the noise generated from pile-driving activities. Compared to the standard impact driving method, vibratory driving substantially reduces the distance that noise exceeds NMFS thresholds, thereby substantially reducing or avoiding the potential to cause take of listed species. However, in certain circumstances (e.g., vibratory driving is not capable of reaching required embedment), impact pile driving may be necessary. Monitoring of underwater sound generated by the vibratory hammer during pile driving in the vicinity of the West False River barrier will be conducted to verify that sound level criteria are not being exceeded as calculated in the effects analysis (i.e., 214 decibels [dB] cumulative sound exposure level [SEL] at approximately 33 feet [10 meters], for each day of pile driving). If levels are exceeded, the permitting fish agencies will be notified and work halted until corrective actions are instituted to achieve sound level criteria.

If impact driving is necessary, bubble curtains will be employed to attenuate noise. As noted above for vibratory driving, monitoring of underwater sound generated by impact driving will be conducted to verify that sound level criteria are not being exceeded as calculated in the effects analysis (i.e., 218 dB cumulative SEL at approximately 33 feet [10 meters], for each day of pile driving). If levels are exceeded, the permitting fish agencies will be notified and work halted until corrective actions are instituted to achieve sound level criteria.

Should EDB installation occur in summer (e.g., July), DWR will confer with the permitting fish agencies regarding the need for sound monitoring and restrictions on pile driving during a period in which few listed fishes would be likely to be exposed to excessive sound levels.

3.8.17 Conduct Scour Monitoring

Prior to installation of the emergency drought barriers, DWR will use low-level aerial surveys to conduct aerial video and photo documentation of the existing conditions, critical channels, and levees (mainly at Fisherman's Cut and Dutch Slough). Similar flights would also be conducted following barrier removal. Aerial video and photo documentation both before barrier installation and after barrier removal would be compared. Additional surveys of existing conditions and post project conditions will also be conducted by boat as needed. Although damage to levees or property is not anticipated based on the expected worse case velocities, DWR would be responsible for repairing any damage documented and verified through the pre- and post-construction surveys.

3.8.18 Install In-Water Navigational Buoys, Lights, and Signage

Navigational buoys, lights, and signage will be installed in Sutter and Steamboat sloughs and West False River upstream and downstream from the emergency drought barrier, to advise boaters about the presence of the emergency drought barrier and maintain navigation along both waterways. DWR will coordinate with the U.S. Coast Guard on signage and buoys.

3.8.19 Implement Turbidity Monitoring During Construction

DWR will monitor turbidity levels in Sutter and Steamboat sloughs and West False River during ground-disturbing activities, including placement of rock fill material and any major maintenance. Monitoring will be conducted by measuring upstream and downstream of the disturbance area to ensure compliance with the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins (Central Valley Regional Water Quality Control Board 2011). For Delta waters, the general objectives for turbidity apply except during periods of stormwater runoff; the turbidity of Delta waters shall not exceed 50 Nephelometric Turbidity Units (NTUs) in the waters of the Central Delta and 150 NTUs in other Delta waters. Exceptions to the Delta specific objectives are considered when a dredging operation can cause an increase in turbidity. In this case, an allowable zone of dilution within which turbidity in excess of limits can be tolerated will be defined for the operation and prescribed in a discharge permit.

DWR contractors will slow or adjust work to ensure that turbidity levels do not exceed the Basin Plan thresholds. If slowing or adjusting work to lower turbidity levels is not practical or if thresholds cannot be met, DWR will stop work and consult with the State Water Resources Control Board and permitting fish agencies to determine the most appropriate BMPs to minimize turbidity impacts to the maximum extent feasible.

3.8.20 Develop a Water Quality Plan to Monitor Water Quality and Operate Barrier Culverts to Improve Water Quality

DWR will develop and implement a water quality plan to assess the effects of the proposed project on flow and water quality in the Central and North Delta. DWR will monitor water quality with solar-powered monitoring instruments upstream and downstream of the Sutter and Steamboat Slough barriers, in addition to assessing monitoring data from existing and recently upgraded stations in the Delta. DWR will open the slide gates of additional culverts to allow greater water flow into Sutter and Steamboat sloughs, should water quality issues arise. NMFS, USFWS, and CDFW will be provided regular updates on culvert operations.

The water quality plan will document the procedures for producing the following elements:

- Water quality data from new monitoring sites and augmentation of existing sites;
- Monthly water quality summaries;
- Monthly water quality maps for Franks Tract (discrete data);
- Final report on project effects on water quality.

3.8.21 Return Disturbed Areas to Pre-Project Conditions And Conserve Habitat

DWR and its construction contractors will strive to limit riparian habitat removal during project-related construction activities, such as site access to Sutter and Steamboat Sloughs. Following barrier removal, DWR will restore riparian habitat to approximate pre-project conditions using native vegetation only. DWR will develop and implement a conceptual mitigation and monitoring plan outlining restoration details. DWR will mitigate for impacts on shallow water habitat at a 3:1 ratio for permanent impacts and a 1:1 ratio for temporary impacts.

3.8.22 Limit Land-Based Access Routes and Construction Area

The number of land-based access routes and each construction area will be limited to the minimum area necessary. Access routes will be restricted to established roadways. Construction area boundaries will be clearly demarcated.

3.8.23 Implement Protocols for Valley Elderberry Longhorn Beetle

DWR will implement protective buffers around known and previously unidentified elderberry shrubs adjacent to project sites or potential material storage sites before the start of construction. A minimum 100-foot buffer will be established and maintained around elderberry plants containing stems measuring 1.0 inch or greater in diameter at ground level.

A fenced avoidance area will be established before the start of construction to protect all elderberry shrubs located adjacent to construction or storage areas. High-visibility fencing will be placed at least 100 feet from the dripline of the shrubs to prevent encroachment of construction workers and vehicles.

If maintaining 100-foot protective buffers around all elderberry shrubs with a stem greater than 1 inch in diameter at ground level is not feasible, DWR will coordinate with USFWS to determine if the specific site conditions allow implementation of reduced buffers to adequately minimize impacts on and avoid take of valley elderberry longhorn beetle.

3.8.24 Implement Protocols for Swainson’s Hawk

The following protocols will be implemented to determine if Swainson’s hawks are nesting within 0.5 mile of any of the project sites, and to avoid, minimize, and mitigate for potential impacts if active nests are found.

3.8.24.1 Preconstruction Surveys

A biological monitor will survey all potential Swainson’s hawk nesting trees within 0.5 mile of each of the proposed project sites no more than 5 days before the start of barrier installation activities at each site. The biologist will conduct a second survey of potential nesting trees and Swainson’s hawk nests no more than 3 days before beginning emergency drought barrier installation at each site. Surveys will also be conducted before geologic exploration that would occur during the Swainson’s hawk nesting season (March 1 – September 15). Results will be reported to CDFW within 24 hours of each survey.

3.8.24.2 Preconstruction Monitoring

During preconstruction surveys (described immediately above), a biological monitor will observe any nest(s) within 0.5 mile of the project sites for at least 1 hour. Nest status will be determined and normal nesting behaviors observed to provide a baseline against which to compare behaviors after construction begins. Results of preconstruction monitoring will be reported to CDFW within 24 hours of each survey.

3.8.24.3 Construction Monitoring

All active Swainson's hawk nests within 0.25 mile of the project sites (the area in which adverse effects are anticipated to occur) will be monitored during construction activities. Monitoring requirements will generally be based on proximity of construction activities to the nest site, as described below. These requirements may be adjusted, based on observed behavior patterns and response to construction activities by the nesting pair and/or their young. Potential adjustments will be evaluated on a case-by-case basis and in consultation with CDFW.

25-Meter Construction Monitoring

Where a Swainson's hawk nest occurs within 25 meters (approximately 80 feet) of construction, a biological monitor will monitor the nesting pair during all construction hours to ensure the hawks are exhibiting normal nesting behavior. Construction activity will be limited to daylight hours.

26–100-Meter Construction Monitoring

Where a Swainson's hawk nest occurs between 26 and 100 meters (approximately 80 to 330 feet) of construction, a biological monitor will observe the nest for at least 3 hours per construction day to ensure the hawks are exhibiting normal nesting behavior. Construction activity will be limited to daylight hours.

101–200-Meter Construction Monitoring

Where a Swainson's hawk nest occurs between 101 and 200 meters (approximately 330 to 655 feet) of construction, a biological monitor will observe the nest for at least 1.5 hours per construction day to ensure the hawks are exhibiting normal nesting behavior.

201–400-Meter Construction Monitoring

Where a Swainson's hawk nest occurs between 201 and 400 (approximately 655 to 1,310 feet) meters of construction, a biological monitor will observe the nest for at least 2 to 3 hours on each of 3 days per construction week to ensure the hawks are exhibiting normal nesting behavior and to check the status of the nest.

401–800-Meter Construction Monitoring

Where a Swainson's hawk nest occurs between 401 and 800 meters (approximately 1,310 to 2,635 feet) of construction, a biological monitor will observe the nest for at least 2 to 3 hours on 1 day per construction week to ensure the hawks are exhibiting normal nesting behavior and to check the status of the nest.

3.8.24.4 Approach Close to Active Nest Trees

If personnel must approach closer than 25 meters (approximately 80 feet) to an active nest tree for more than 15 minutes while adults are brooding, the nesting adults will be monitored for signs of stressed behavior. If stressed behavior is observed, personnel will leave until the behavior normalizes. If personnel must approach closer than 50 meters (approximately165 feet) for greater than 1 hour, the same applies. All personnel outside vehicles will be restricted to greater than 100 meters (approximately 330 feet) from the nest tree unless construction activities require them to be closer, and the personnel will remain out of the line of sight of the nest during work breaks.

3.8.24.5 Authority to Stop Construction

If a biological monitor determines that a nesting Swainson's hawk is significantly disturbed by project activities, to the point where nest abandonment is likely, the biological monitor will have the authority to immediately stop project activity and work will cease until the threat has subsided. The biological monitor will notify CDFW if nests or nestlings are abandoned, and if the nestlings are still alive, to determine appropriate actions.

3.8.24.6 Salvage of Eggs and Young

If an abandonment of a nest with eggs or nestlings occurs during barrier construction, DWR will initiate action to retrieve any abandoned eggs or nestlings and deliver them to a CDFW-approved wildlife care facility for rearing and later return to the wild using methods acceptable to CDFW. DWR will fund the recovery, rearing, and controlled release of the young. Persons handling eggs and/or young birds will be qualified and approved by CDFW to conduct retrieval of abandoned eggs or nestlings.

3.8.24.7 Tree Preservation

Removal of live trees with trunks in excess of 4 inches in diameter at breast height (dbh) will be avoided to the greatest extent practicable. To protect trees that can be preserved in the construction area, all trees 4 inches or greater in dbh located from the water edge to the levee crown will be flagged for avoidance prior to any work.

3.8.24.8 Compensatory Mitigation

DWR will provide compensatory mitigation for any loss of trees in excess of 4 inches dbh. Before the start of construction, DWR will conduct a survey of all trees that require removal and record characteristics of those greater than 4 inches dbh, including species, dbh, and height. Appropriate replacement ratios (minimum of 1:1), location of tree replacement plantings, and success criteria will be determined in consultation with and approved by CDFW.

DWR will also provide mitigation to compensate for the potential impacts of reduced nest productivity or nest failure as a result of construction activities. If an active nest is present within 0.5 mile of a project site during barrier construction and project activities could result in reduced nest productivity, DWR will provide compensation for this potential impact. The circumstances under which compensation will be provided will depend on local conditions, such as distance from the nest to the project site, baseline human activity levels in the vicinity of the nest, and observed behavior of the nesting pair and will be determined in consultation with CDFW. If a monitored nest is abandoned and nestlings are still alive, DWR will fund the recovery and hacking (controlled release) of the nestlings. If a nest is abandoned and the nestlings do not survive, DWR will provide compensation for this loss. The appropriate amount and nature of the compensation will be determined in consultation with and approved by CDFW, based on the specific circumstances of the impact, and all mitigation will be implemented in accordance with the ITP issued for the project. Potential compensation mechanisms may include permanent protection and management of habitat for Swainson's hawk at a mitigation bank, contribution to a Swainson's hawk conservation fund, or other feasible means of promoting the long-term conservation of the species.

3.8.25 Implement Protocols for Burrowing Owls

The following protocols will be implemented to determine if burrowing owls are present in or adjacent to EDB activity areas that support potentially suitable habitat, and to avoid and minimize potential impacts if occupied burrows are found.

3.8.25.1 Habitat Assessment and Preconstruction Surveys

A qualified biologist will conduct an assessment of burrowing owl habitat suitability at the West False River barrier site and the Rio Vista stockpile site (if applicable). The assessment will evaluate the area subject to direct impact, as well as adjacent areas within 150 to 500 meters (approximately 490 to 1,640 feet), depending on the potential extent of indirect impact. If suitable habitat or sign of burrowing owl presence is observed, surveys and reporting will be conducted in accordance with Appendix D of CDFW's Staff Report on Burrowing Owl Mitigation (CDFW 2012). At a minimum, an initial take avoidance survey will be conducted no less than 14 days before stockpiling activities begin and a second survey will be conducted within 24 hours before activities begin. If sign of burrowing owl presence is observed during the habitat assessment, the full survey protocol (four surveys during the breeding season and four surveys during the non-breeding season) will be implemented, to the extent feasible, depending on timing of project implementation and stockpiling activities.

3.8.25.2 Impact Avoidance and Minimization

If any occupied burrows are observed, DWR will develop and implement avoidance and minimization measures, such as protective buffers, in consultation with CDFW. A qualified biologist will monitor the occupied burrows before and during stockpiling activities to inform development of and confirm effectiveness of these measures. If it is determined, in consultation with CDFW, that passive exclusion of owls from the stockpile area is an appropriate means of minimizing direct impacts, such exclusion will be conducted in accordance with an exclusion and relocation plan developed by DWR in coordination with and approved by CDFW.

Burrows occupied during the breeding season (February 1 through August 31) will be provided a protective buffer until a qualified biologist verifies through noninvasive means that either (1) the birds have not begun egg laying or (2) juveniles from the occupied burrows are foraging independently and are capable of independent survival. The size of the buffer will depend on distance from the nest to the project footprint, type and intensity of disturbance, presence of visual buffers, and other variables that could affect susceptibility of the owls to disturbance.

3.8.26 Implement Protocols for Nesting Raptors other than Swainson's Hawk and Burrowing Owl

The following protocols will be implemented to determine if raptors other than Swainson's hawk and burrowing owl are nesting on or adjacent to any of the project sites, and to avoid and minimize potential impacts if active nests are found.

3.8.26.1 Tree Removal

If removal of suitable nest trees is required for barrier installation, such removal will be conducted between September 16 and January 31 (outside of the raptor nesting season), to the extent feasible.

3.8.26.2 Preconstruction Surveys

Focused surveys for active nests of Cooper's hawk, white-tailed kite, and other common raptors will be conducted by a qualified biologist in areas of suitable nesting habitat within 500 feet of project activity areas at each barrier site. Surveys will be conducted within 10 days before the start of project activities (including geologic exploration) that would occur during the raptor nesting season (February 1 – September 15).

3.8.26.3 Impact Avoidance and Minimization

If an active nest is identified, an appropriate protective buffer will be determined by the biologist, in coordination with CDFW. The size of the buffer will depend on site-specific conditions and potential disturbance levels. Construction-related activities within the buffer will be avoided to the extent feasible until the nest is no longer active. If construction activity is necessary within the buffer, a qualified biologist will monitor the nesting adults and/or young for signs of stressed behavior. If behavior suggesting potential for nest failure is observed, project activity within the buffer will be reduced until behavior normalizes. Frequency and duration of monitoring will depend on the location and intensity of construction activity within the buffer and will be determined by the biologist, in coordination with CDFW.

3.8.27 Implement Protocols for Migratory Birds

The following protocols will be implemented to determine if migratory birds are nesting on or immediately adjacent to any of the project sites, and to avoid and minimize potential impacts if active nests are found.

3.8.27.1 Vegetation Removal

If removal of woody or herbaceous vegetation is required for barrier installation, such removal will be conducted between September 1 and March 1 (outside of the migratory bird nesting season), to the extent feasible.

3.8.27.2 Preconstruction Surveys

Focused surveys for active nests of migratory birds will be conducted by a qualified biologist on and immediately adjacent to each barrier site. Surveys will be conducted within 10 days before the start of project activities (including geologic exploration) that would occur during the nesting season (March 1 – August 31).

3.8.27.3 Impact Avoidance and Minimization

If an active migratory bird nest is found within the construction footprint, the biologist will develop appropriate measures, such as implementation of a protective buffer, to avoid disturbance of the nest until it is no longer active.

3.8.28 Implement Protocols for Special-status Plants

The following protocols will be implemented to determine if special-status plants are present on or immediately adjacent to any of the project sites, and to avoid and minimize potential impacts if active nests are found.

3.8.28.1 Pre-construction Surveys

Each year in which barrier installation may be required, a focused survey for delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), Mason's lilaeopsis, delta mudwort (*Limosella australis*), Sanford's arrowhead (*Sagittaria sanfordii*), woolly rose-mallow (*Hibiscus lasiocarpos* var. *occidentalis*), and any other special-status plant that may occur at a project site will be conducted by a qualified botanist in areas of suitable habitat in the ground disturbance footprints and within 25 feet of the footprint boundaries. To the extent feasible depending on timing of barrier installation, surveys will be conducted at an appropriate time of year during which the species are likely to be detected, generally during the blooming period.

3.8.28.2 Impact Avoidance and Minimization

If Mason's lilaeopsis is detected, a qualified botanist will ensure the area occupied by this species is fenced for complete avoidance during barrier installation, operation, and removal. Habitat occupied by other special-status species will also be fenced and avoided, to the extent feasible.

If special-status plants (other than Mason's lilaeopsis) cannot be avoided, a qualified botanist will assess the feasibility of salvaging and transplanting individual plants to be removed, collecting and planting seeds of plants to be removed, and/or collecting and translocating seed- and rhizome-containing mud to nearby areas of suitable habitat. If such actions are deemed feasible, they will be implemented under the direction of the botanist, and in coordination with CDFW.

3.8.29 Minimize Wildlife Attraction

To eliminate attraction of wildlife to the project sites, all food-related trash items, such as wrappers, cans, bottles, and food scraps, will be disposed of in closed containers and removed from the sites on a daily basis.

3.8.30 Minimize Downstream Water Surface Elevation Impacts and Work with North Delta Water Agency to Minimize Salinity Changes for Water Users within the Agency's Boundaries

DWR will work with affected agricultural diverters and the North Delta Water Agency to agree upon acceptable measures to minimize potential water surface elevation decreases caused by the Sutter and Steamboat Slough barriers. In the event of a diversion deficiency downstream from the Sutter and Steamboat Slough barriers, and in coordination with affected landowners, DWR will:

1) Respond with a site visit within 24 hours of phone notification of a diversion deficiency from an affected landowner,

2) Determine if the diversion deficiency is due to reduced stage caused by the Sutter and Steamboat Slough barriers, and

3) Identify and implement a preferred corrective action, such as changing the intake depth by attaching a length of pipe to extend an existing pipe or shorten a pipe if the pipe is buried in sediment. Corrective actions will be implemented in accordance with the following criteria:

   – The performance standard is to return affected diversions to their pre-project equipment capacities.

   – The type of diversion cannot be changed, e.g., siphons cannot be replaced with a permanent pump or vice versa. Temporary pumps may be installed to assist any type of diversion. Intake size cannot be increased, e.g., an 8-inch pipe replaced with a 12-inch pipe.

   – Intakes will not be relocated; maintenance dredging will not be conducted; and corrective actions cannot require additional U.S. Army Corps of Engineers permit application and approval, which would require substantial delays in implementing the corrective action.

DWR will also reach agreement with North Delta Water Agency to ensure that any salinity increases remain below the State Water Resources Control Board limits set in Water Rights Decision 1641 as amended. DWR remains committed to fulfilling its commitments in the 1981 Contract between State of California Department of Water Resources and North Delta Water Agency for the Assurance of a Dependable Water Supply of Suitable Quality.

4. Potential for Incidental Take of Covered Species

Incidental take of longfin smelt may occur during project construction and operation as a result of injury or mortality of individuals caused by pile driving and rock placement; substrate disturbance resulting in increased turbidity, suspended sediments, and water column contaminant levels; deterrence from migratory pathways; or increased predation in the vicinity of the rock barriers. Quantitative estimates of potential take are not possible because of lack of fish sampling or monitoring data in the immediate project area, and lack of appropriate analytical methods to quantify losses.

Incidental take of Swainson's hawk could occur if noise and visual disturbances associated with installation and operation of the EDB are substantial enough to cause nest abandonment or nestling mortality and measures described in Section 3.8.24 are not adequate to prevent such take. Quantitative estimates of potential take are not possible because it is not known if Swainson's hawk will nest in the vicinity of the project sites.

5. Impacts to Covered Species

5.1 Potential Occurrence in Project Area

5.1.1 Longfin Smelt

Although longfin smelt could occur in the vicinity of the Sutter and Steamboat Slough sites, it is anticipated that very few individuals would occur so far upstream during construction and operation of the EDB; the West False River site has more potential for longfin smelt occurrence. During the construction period (beginning as early as May), longfin smelt could occur in the vicinity of the West False River site. Merz et al. (2013) summarized the occurrence of longfin smelt from different surveys undertaken in the San Francisco Estuary, including the Delta. They found that longfin smelt larvae were commonly collected in the lower San Joaquin River (i.e., in the vicinity of the West False River barrier site), i.e., in an annual average of 63% of San Francisco Bay Plankton Net samples (January-June) from 1980 to 1989, in 31% of 20-mm survey samples (March-June) from 1995 to 2011, and in 92% of Smelt Larval Survey samples (January –March) from 2009 to 2011. Juveniles were collected in an average of only 1% of San Francisco Bay Study Otter Trawl samples (April-October) from the lower San Joaquin River, whereas juveniles were collected in 12% of 20-mm samples (April-July). The decrease in frequency of occurrence between the larval and juvenile stages of the life cycle reflects a general movement downstream that would be expected to result in fewer individuals being present during the bulk of the EDB operations period (which could last from mid-early June to October). Baxter et al. (2010) reviewed the factors affecting the species and noted that studies have shown that temperatures >22°C limit the species' distribution and cue emigration; such temperatures would be routinely expected in the vicinity of the West False River barrier during summer/early fall. As noted by Baxter et al. (2010), upstream migration occurs in winter. Sub-adult longfin smelt were found in an average of 8% of fall midwater trawl survey samples undertaken in the lower San Joaquin River in November-December of 1980-2011 (Merz et al. 2013).

Overall, the proportion of the total longfin smelt population near the EDB during EDB construction (beginning in May at the earliest), operation (mid-early June to October), and removal (October-November) is expected to be relatively small, but individuals occurring in the Project Area could be affected by the EDB. In addition, the abutments at the West False River site would be left in place and could have effects on longfin smelt occurring in the area after EDB removal, as discussed below in section 5.3.1.3 *Near-Field Predation Impacts.*

5.1.2 Swainson's Hawk

Swainson's hawks are primarily summer residents in the Delta, but small numbers are also known to winter there. Pairs typically begin to establish nesting territories in March, and egg-laying generally occurs in early April to early May (CDFG 1994). In the Central Valley, Swainson's hawks nest in riparian areas or isolated trees, typically adjacent to or within close proximity of suitable foraging habitat. They prefer relatively tall trees (mean height of approximately 50 feet), and the species most commonly used are valley oak, cottonwood, and willows (CDFG 2007). Suitable foraging habitat includes agricultural crops (alfalfa, row crops, and hay crops), pasturelands, and annual grasslands.

All three project sites are within the portion of the Swainson's hawk breeding range that supports the highest density of active nests in the Central Valley (CDFG 2007). Swainson's hawk nests have been documented in the vicinity of all three sites, including three nest locations within 0.5 mile of the Steamboat Slough site and one location within 0.5 mile of both the Sutter Slough and West False River sites (DWR 2013). Suitable nest trees are present along both sides of Sutter and Steamboat Sloughs within and adjacent to the project sites. There are few suitable nest trees in the vicinity of the West False River site but several are present.

5.2 Construction and Removal Impacts

5.2.1 Longfin Smelt

The potential for occurrence of longfin smelt during EDB construction and removal was discussed above in section 5.1 *Potential Occurrence in Project Area.* The installation of the EDB has the potential to harass and displace longfin smelt present in the general area of the construction activity, primarily because of in-water rock placement and any associated pile driving that would occur. Additionally, the increased turbidity levels associated with construction may negatively impact longfin smelt temporarily through reduced availability of food, reduced feeding efficiency, and exposure to toxic sediments released into the water column. Removal of the EDB in October/November may be less likely to affect longfin smelt because the timing of that action would not overlap with the general occurrence of the species in the locations of the barriers, although this is dependent on environmental conditions (e.g., water temperature, salinity, and turbidity).

Pile driving will be used in the construction of the West False River barrier, as noted in the Project Description. High levels of underwater noise from pile driving can adversely affect some fish species,[3] as discussed by NMFS and others (Hastings and Popper 2005; Popper et al. 2006; Carlson et al. 2007; NMFS 2008). To the extent possible, the EDB will use a vibratory hammer to install the sheet pile dikes and king piles (wall) at the West False River barrier; however, impact driving may be necessary for some pile driving. Vibratory hammers are generally much quieter than impact hammers and are routinely used on smaller piles (ICF Jones & Stokes and Illingworth & Rodkin 2009). Fish impacts from exposure to pile driving activities were reviewed by Hastings and Popper (2005), and they provided recommendations to protect fish from physical injury (see also Popper et al. 2006; Carlson et al. 2007). In 2008 NMFS, USFWS and CDFG adopted interim criteria of a peak sound pressure level of 206 dB referenced to 1 µPascal per second and a cumulative (SEL) of 187 dB referenced to 1µPascal per second for fish greater than or equal to 2 grams in weight and 183 dB referenced to 1µPascal per second for fish less than 2 grams in weight (Fisheries Hydroacoustic Working Group 2008, ICF Jones & Stokes and Illingworth & Rodkin 2009). Although these criteria were specific to impact or percussive pile driving, they have served as a general guideline for noise thresholds for the onset of physical injury in fish exposed to the impact sound associated with pile driving (NMFS 2008).

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3 Three metrics are commonly used in evaluating hydroacoustic impacts on fish: peak sound pressure level, root mean square (RMS) sound pressure, and sound exposure level (SEL) (ICF Jones & Stokes and Illingworth & Rodkin 2009). SEL is defined as the constant sound level acting for one second, which has the same amount of acoustic energy as the original sound (Hastings and Popper 2005). Reference sound levels from pile driving normally are reported at a fixed distance of 10 meters. Underwater peak and RMS decibel levels are usually referenced to 1 micropascal (µPa), and the SEL is referenced to 1 micropascal squared per second (dB re: $1\mu Pa^2$-s) (Hastings and Popper 2005).

Pile driving at the West False River barrier site would occur over a several-day period in order to install the two sheet pile walls and associated eight king piles. It is anticipated that a vibratory hammer will be used for the sheet and king pile driving, which is quieter than impact driving (ICF Jones & Stokes and Illingworth & Rodkin 2009). Vibratory driving appears to be feasible given the anticipated ground conditions and modest pile penetration of 20-50 feet into the ground (Broadbaek, pers. comm.). Vibratory penetration rates are normally limited to 20 inches per minute (per North American Sheet Piling Associations – Best Practices, www.nasspa.com), which would result in the following maximum vibration times per pile assuming normal driving conditions:

- 20-ft ground penetration: 12 minutes
- 50-ft ground penetration: 30 minutes

Because of uncertainties in ground conditions and the possibility of encountering dense soil layers or obstructions such as left-in-place rip-rap on the existing levee side slopes, a larger impact hammer would be used as a contingency measure, in the event that unexpected harder driving is encountered. The impact hammer would only be used if the vibratory hammer cannot reach the design tip elevation of the pilings.

Although peak sound levels of vibratory hammers can be substantially less than those produced by impact hammers, the total energy imparted can be comparable to impact driving because the vibratory hammer operates continuously and requires more time to install the pile (ICF Jones & Stokes and Illingworth & Rodkin 2009). Sound levels during vibratory pile driving were measured at the City of Stockton Downtown Marina (ENTRIX 2008). Peak sound pressure levels ranged from 184 to 202 dB, while accumulated SELs ranged from 181 to 195 dB, as measured at 10 m from the pile and mid-water depth (approximately 2 to 3 m below the water surface). The duration of pile driving ranged from approximately 6 to 12 minutes, with periods of 11 to 71 minutes between pile driving (Power Engineering and City of Stockton 2008). The peak sound pressure levels were below recommended levels, while the accumulated SELs slightly exceeded the recommended criteria by 8 dB. During the 5-week period of observing each pile installation at the City of Stockton Downtown Marina, technicians did not observe effects on fish species related to the pile installations.

Appendix B of the Biological Assessment for ESA-listed fishes presents an analysis for potential pile driving effects for the EDB, including barrier piles (i.e., king piles and sheet piles) at the West False River site, water quality equipment monitoring piles, and float line piles upstream and downstream of the West False River site. This analysis examined various potential scenarios for the duration of pile driving, given lack of exact knowledge about the number of piles to be driven per day. The analysis suggested that the potential zone of effect (i.e., the zone within which there is potential for take through physical injury or harassment causing displacement) for vibratory pile driving of barrier piles could extend almost 500 meters upstream and downstream from the site of pile driving at the West False River barrier;[4] the zone of effect for impact driving varied broadly depending on the number of strikes necessary for pile driving (maximum of 1,000 meters for many strikes per day). As described in section 3.7 *Environmental Commitments,* vibratory pile driving would be used whenever possible, and driving would be halted should daily cumulative SEL at 10 meters exceed the greatest values estimated from the pile driving effects analysis, i.e., 214 dB for vibratory driving and 218 dB for impact driving.

[4] This distance is based on sound pressure criteria for effects on fishes that were adopted for impact driving; as noted in Appendix B, suggested criteria for vibratory driving would give a shorter distance to sound pressure thresholds and therefore a smaller zone of impact.

The use of vibratory driving whenever possible, the adoption of attenuation measures for any impact driving (i.e., bubble curtains; see section 3.8 *Environmental Commitments*), combined with sound monitoring to limit pile driving should thresholds be exceeded, are intended to minimize the potential for take of listed fish species during pile driving.

Anticipated responses of any fish within the work area may be more likely to be behavioral in nature (e.g., startle response and avoidance), although these would diminish with distance from the construction sites. Hastings and Popper (2005) concluded that data are lacking on behavioral responses to pile driving, such as a startle response to noise or movement away from highly utilized habitats impacted by sound. Carlson et al. (2001) reported migrating juvenile salmon reacting with startle behavior in response to routine channel maintenance activities in the Columbia River. Some of the fish that did not immediately recover from the disorientation of turbidity and noise from channel dredges and pile driving swam directly into the point of contact with predators. The total impact to aquatic habitat is just over 4 acres (Table 5).

Table 5. Barrier Footprint Acreages

Barrier	Aquatic Footprint (acres)[1]	Terrestrial Footprint	Total Footprint
Sutter Slough Barrier	0.454	0.003	0.457
Steamboat Slough Barrier	0.837	0.177	1.014
West False River Barrier	2.650	0.000	2.650
Total	3.941	0.180	4.121

1 Based on area below OHWM of +6.5 feet at Steamboat and Sutter Sloughs and below +5.5 feet at West False River and as shown in Appendix A.

The construction of the EDB may take, however, take is anticipated to be limited because:

- construction and removal is spatially limited relative to the potential areas in which the species occurs, and removal would take place when relatively few longfin smelt would be expected to occur in the vicinity of the EDB;
- the effects would be temporary (total construction period of around 30-60 days at all sites, and total removal period of around 45-60 days at the West False River site and around 30-60 days for the Sutter and Steamboat Slough sites);
- pile driving on each day would be limited not to exceed NMFS-established thresholds for injury to fishes, and would be undertaken with a vibratory pile driver to the extent possible, with any necessary impact driving incorporating bubble curtains and other environmental commitments to attenuate noise effects (see section 3.7 *Environmental Commitments*);
- sound data taken during the 2012 installation of rock barriers as part of the TBP showed that noise levels at 100 m from construction were below the NMFS criteria for adverse behavioral effects (Shields 2012),[5] suggesting that the area of construction effects from rock placement

[5] For the TBP, the greatest measured peak sound pressure at 100 m was 149 dB for a single bucket drop of rock at the Old River near Tracy barrier. No measurements exceeded the NMFS 2012 South Delta Temporary Barriers Project BO ecological surrogate threshold of 150 dB at 100 m (Shields 2012). Applying the 149-dB peak value to equation 4-2 of ICF Jones and Stokes and Illingworth and Rodkin (2009; i.e., distance to threshold = distance to 149-dB measurement / ($10^{[149dB – pressure threshold in dB] / 15 (i.e., the assumed attenuation coefficient)}$)) gives distances to peak thresholds of 86 m for a 150-dB threshold and less than a meter for a 206-dB threshold.

would be smaller than 100 m (recognizing that there remains the potential for much of the channel width to be affected by intense transient noises during construction[6]);

- the effects of noise on fish would likely be limited to avoidance behavior in response to movements, noises, and shadows caused by construction personnel and equipment operation in or adjacent to the river (recognizing that avoidance of the disturbed areas could make fish more susceptible to predation at other areas);
- juvenile and adult longfin smelt in the area are expected to move away from the area of disturbance (any larval longfin smelt in the area may move away more slowly because of their smaller size and weaker swimming ability, therefore resulting in more exposure to disturbance than adults and juveniles);
- DWR has included a number of environmental commitments to limit the potential for take (see section 3.7 *Environmental Commitments*).

5.2.2 Swainson's Hawk

Based on documented occurrences of past Swainson's hawk nests in the vicinity of the project sites, it is likely an active nest would be present within 0.25 mile of at least one project site in years when barriers are installed. Noise and visual disturbances associated with EDB installation could adversely affect nesting Swainson's hawks if an active nest is present nearby. Adverse effects of sufficient magnitude could result in nest abandonment, a reduction in the level of care provided by adults (e.g., duration of brooding, frequency of feeding), or forced fledging. The environmental commitments described in section 3.8.24 would reduce adverse effects and minimize potential for the project to result in take of Swainson's hawk. As mentioned above, the potential level of take cannot be quantified at this time, because it is not known how close to the project sites Swainson's hawks will nest in years when barriers are installed. Removal of the EDB would occur after the nesting season has ended and does not have potential to result in take.

5.3 Operations Impacts

5.3.1 Longfin Smelt

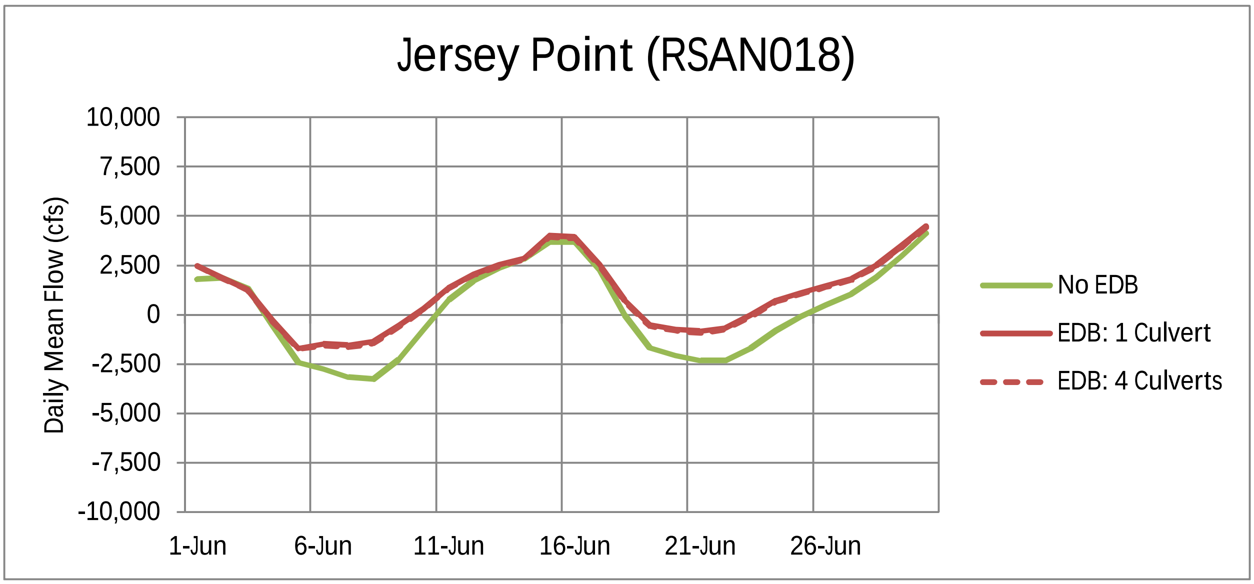
5.3.1.1 Hydrodynamic Impacts

Early operations of the EDB in mid-early June would have the potential to reduce slightly the likelihood of entrainment toward the south Delta export facilities of longfin smelt larvae and juveniles occurring in the lower San Joaquin River. The West False River barrier would reduce the potential for longfin smelt to move through Franks Tract and into Old River. Modeling based on simulated hydrology[7] suggested that the potential for greater tidal flow up the lower San Joaquin River (between the mouth of West False River and the mouth of Old River) is counteracted by more

[6] In addition to rock placement during construction, rock placement may occur at the permanent abutments should annual inspections show displacement of rocks from these structures; however, there are expected to be no adverse effects from these rock placements on listed fishes because the work would be of limited extent and would occur during the summer in-water work window.

[7] The simulations based on the simulated hydrology that are discussed in this ITP application assumed the EDB to be installed on June 1 and the DCC operated per D-1641. See Appendix E of the Biological Assessment for ESA-listed fishes for further description.

flow coming down the Mokelumne River because of the Sutter and Steamboat slough barriers.[8] This is reflected in net flows at Jersey Point being higher (more positive) with the EDB than a case with no EDB, assuming DCC gates operated per D-1641:[9] with EDB operations commencing June 1, mean June flow just over 1,070 cfs for EDB (with one culvert open on each of the Sutter and Steamboat slough barriers) and just under 230 cfs for the no-EDB case (Figure 10). Operation of the EDB would provide an increase in the net positive flow from the Mokelumne River mouth past Antioch (Figure 11). As might be expected, there is a minimal difference in mean daily flow between EDB one-culvert-open and all-culvert-open scenarios for the San Joaquin River at Jersey Point and Antioch (Figures 10 and 11). Opening the DCC gates during portions of May and June may result in a marginally lower risk of entrainment for longfin smelt in the lower San Joaquin River, based on results of particle tracking modeling for particles released in Georgiana Slough (see Figure 13C of Kimmerer and Nobriga 2008).

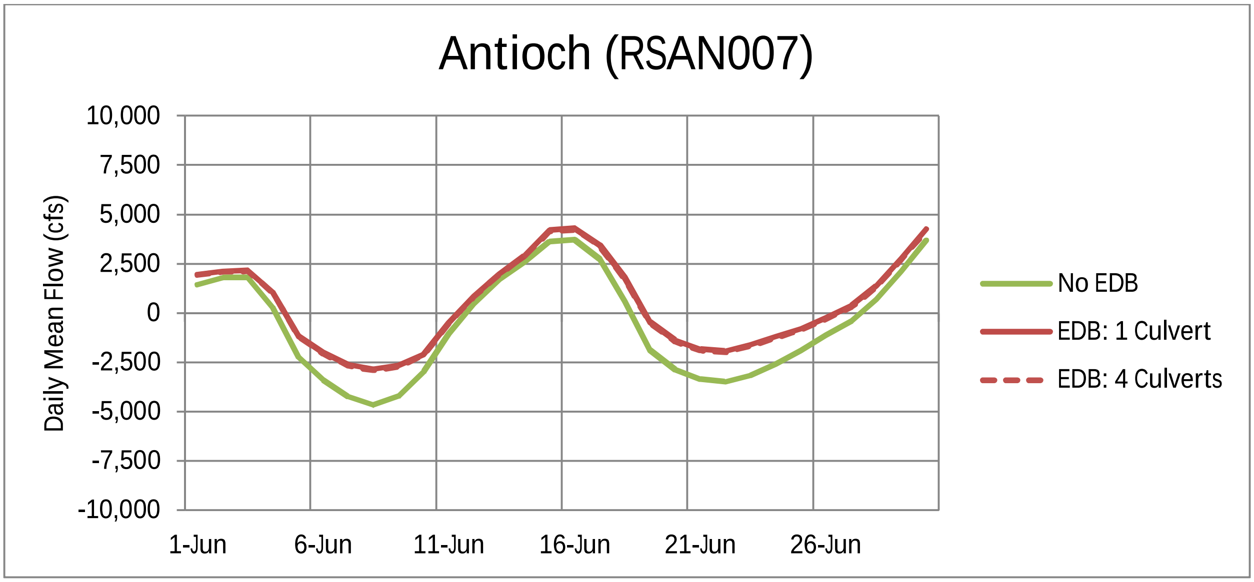


Source: Liu, pers. comm. Note: Scenarios include no EDB, EDB with one culvert open, and EDB with all (four) culverts open. Delta operations do not differ between scenarios and are described in Appendix E of the Biological Assessment for ESA-listed fishes. EDB assumed installed June 1, removed October 31.

Figure 10. Mean Daily Flow at Jersey Point from June 1 to June 30, from DSM2-HYDRO Modeling, Based on Simulated Hydrology and Delta Cross Channel Operated Per D-1641.

[8] This phenomenon would be true for any pair of EDB and no-EDB scenarios that have the same inflow and exports as each other; it is not unique to the simulated hydrology described in Appendix E of the Biological Assessment for ESA-listed fishes.

[9] Further description of the assumptions related to the modeling based on the simulated hydrology are provided in Appendix E of the Biological Assessment for ESA-listed fishes.

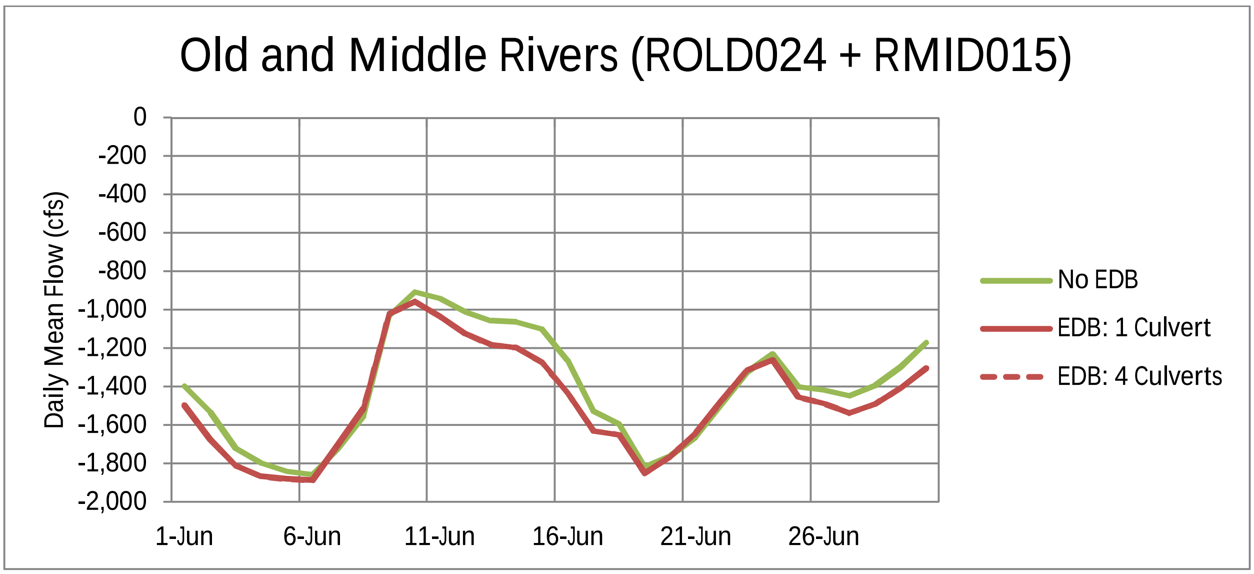


Source: Liu, pers. comm. Note: Scenarios include no EDB, EDB with one culvert open, and EDB with all (four) culverts open. Delta operations do not differ between scenarios and are described in Appendix E of the Biological Assessment for ESA-listed fishes. EDB assumed installed June 1, removed October 31.

Figure 11. Mean Daily Flow at Antioch from June 1 to June 30, from DSM2-HYDRO Modeling, Based on Simulated Hydrology and Delta Cross Channel Operated Per D-1641.

As noted above, installation of the West False River barrier would have the potential to reduce entrainment of longfin smelt in the lower San Joaquin River into Franks Tract and Old River (and ultimately the SWP/CVP south Delta export facilities) by blocking off one of the main points of entry into the south Delta. However, seepage flow between the rocks of the barrier towards the south Delta has the potential to result in impingement of small longfin smelt (e.g., larvae and early juveniles). Analyses presented in Appendix D of the Biological Assessment for ESA-listed fishes were used to assess the potential for seepage flow through all three proposed barriers. The analysis for the West False River barrier suggested that seepage flow would be very low (median of 0 cfs, range from around -80 to just over 370 cfs, for the June 1-30 period; Table D6 in Appendix D of the Biological Assessment for ESA-listed fishes) and that therefore there would be low risk to larval/early juvenile longfin smelt from impingement because this flow is very low compared to nearby tidal flow at Jersey Point (median of 12,000 cfs, range -150,000 to 130,000 cfs). Without the EDB, median flow in False River was 7,500 cfs (range -57,300 to 52,800 cfs). Without the West False River barrier, a substantial portion of the San Joaquin River flood tide (upstream) flows are diverted into Franks Tract. The net flow was positive (downstream) from Franks Tract to the San Joaquin River near Jersey Point, because some of the San Joaquin River ebb tide (downstream) flow enters Franks Tract at the mouth of Old River and leaves Franks Tract through False River.

Operation of the West False River barrier could trap longfin smelt that are present upstream of the barrier (e.g., in the Franks Tract area). With the EDB changing hydrodynamics in the central and south Delta, Old and Middle River (OMR) flows become slightly more negative in the modeling based on DSM2-HYDRO modeling for the simulated hydrology (Figure 12), which is a function of differences in hydrodynamics caused by the West False River barrier (and not because more exports occurred under the EDB scenarios). The West False River barrier changes the San Joaquin River flood tide pathway into Franks Tract, and moves the tidal connection about 20 kilometers upstream to the mouth of Old River. These hydrodynamic changes in the tidal elevations and corresponding tidal flows in the San Joaquin River, Franks Tract, and Old and Middle River channels also would slightly shift the distribution of the OMR flows. The magnitude of Old River tidal flows would be slightly less with the EDB, but the net upstream flow (negative) in Old River would be slightly greater with the EDB. The net upstream flow (negative) in Indian Slough, which connects to Rock Slough and bypasses the Old River flow station, would be slightly less, thereby making the OMR as measured in Old and Middle Rivers greater by about 65 cfs with no EDB. However, the flow in Old River at Highway 4 and the flow in Victoria Canal (total flow towards the exports) would remain the same with the barriers (average of -1,875 cfs for June in the illustrative example based on the simulated hydrology discussed in Appendix E of the Biological Assessment for ESA-listed fishes). Although the same net flow would move towards the exports, much less seawater intrusion and a smaller fraction of the larval and juvenile fish occurring in the lower San Joaquin River channel in the vicinity of Antioch and Jersey Point would be tidally mixed into Franks Tract or entrained at the export facilities.



Source: Liu, pers. comm. Note: Scenarios include no EDB, EDB with one culvert open, and EDB with all (four) culverts open. Delta operations do not differ between scenarios and are described in Appendix E of the Biological Assessment for ESA-listed fishes. EDB assumed installed June 1, removed October 31.

Figure 12. Mean Daily Flow at Old and Middle Rivers from June 1 to June 30, from DSM2-HYDRO Modeling, Based on Simulated Hydrology and Delta Cross Channel Operated Per D-1641.

The fate of longfin smelt found southeast of the West False River barrier may well be entrainment at the south Delta export facilities regardless of the presence of the barrier, based on simulated fates of neutrally buoyant particles (Kimmerer and Nobriga 2008).

The DSM2-HYDRO modeling data based on simulated hydrology and discussed above for Jersey Point and Antioch flows illustrated that there would be essentially no effect of barrier culvert operations on mean daily OMR flow, using June as an example month (Figure 12).

5.3.1.2 Water Quality Impacts

Water quality impacts of the EDB on longfin smelt would be limited because, as noted above in the section 5.1 *Potential Occurrence in the Project Area,* the species is largely downstream during the main period of barrier operation (summer/early fall) that could be affected by changed water quality in the lower Sacramento River and downstream of the Sutter and Steamboat Slough barriers. Most of the longfin smelt population would be expected to reside downstream of the Delta during the EDB operations period, and therefore would not be affected by water quality issues as there would be no change in Delta outflow. Water quality in the Project Area would be monitored and culvert openings would occur if water quality issues arose that could be detrimental to fish (see section 3.8 *Environmental Commitments*).

5.3.1.3 Near-Field Predation Impacts

Predatory fish may congregate below manmade barriers in rivers to feed on prey passing through the barriers. For example, Tucker et al. (1998) described the problem of relatively high predation of juvenile Chinook salmon below RBDD on the Sacramento River. Predatory fish (e.g., largemouth bass [*Micropterus salmoides*]) fitted with acoustic tags have been shown to associate with the head of Old River barrier that was installed in 2012 (DWR unpublished data), and predation rates of acoustically tagged Chinook salmon juveniles at or near the barrier were high. Also within the Delta, Sabal (2014) showed that striped bass congregated below Woodbridge Irrigation District Dam (Mokelumne River) at higher densities than at other anthropogenically altered sites in the lower Mokelumne River (which in turn had greater densities of striped bass than natural sites); the per capita consumption of juvenile Chinook salmon at the dam was also higher than at other areas. Whereas enhanced predation of juvenile salmonids in relation to artificial structures has been observed in the Central Valley and Delta (Tucker et al. 1998, Sabal 2014), there have not been observations of such predation on longfin smelt. Nevertheless, predation at greater rates than normal may result should longfin smelt occur in close proximity to any of the barriers.

The barriers in Steamboat and Sutter Sloughs would be removed entirely by November 1, whereas the abutments (sheet piles and king piles) at the West False River barrier would be left in place. As noted in section 3 *Project Description,* the sheet piles would extend approximately 75 feet from the levee into the river channel; installation of rock transitions would be done to limit the potential for creation of hydrodynamic eddies that could form ambush habitat for predatory fishes. However, some enhanced level of predation attributable to the presence of the remaining abutment structures could occur on longfin smelt (primarily adults moving into nearshore areas to spawn, or to avoid ebb tides during upstream spawning migration).

5.3.2 Swainson's Hawk

Operation of the EDB at the Sutter Slough and West False River locations is unlikely to result in take of Swainson's hawk, because noise and visual disturbance associated with operations activities at these sites would be minimal and unlikely to cause disturbance of a level that could result in take.

Noise and visual disturbance associated with operation of the EDB at Steamboat Slough would be greater because boat traffic would be transferred from one side of the barrier to the other via a trailer on the temporary boat ramps. Disturbance could be sufficient to result in take if an active nest is located very near to either boat ramp. However, disturbance levels associated with EDB installation would be greater in magnitude, and if nearby nesting Swainson's hawks are present after EDB installation has been completed, they are unlikely to be disturbed by operations.

5.4 Consecutive-Year-Implementation Effects

As noted in the project description, the project could be implemented in three years out of ten years. Effects of implementing the project in three consecutive years or in three out of four or five years could differ compared to implementing in three years well-spaced through the 10-year period.

5.4.1 Longfin Smelt

The analysis of the EDB in this ITP application generally focuses on the effects to longfin smelt within a single year of project implementation, although any near-field predation effects on longfin smelt from the abutments left in place at the West False River barrier would continue to occur indefinitely. From a population dynamics perspective, implementation of the project in three consecutive years or in three out of four or five years may be more detrimental to longfin smelt than implementation in three years well-spaced through the 10-year period. This is because there is evidence of the abundance of longfin smelt adults being positively related to the abundance of their resulting progeny (represented by adult abundance two years later), i.e., a stock-recruitment relationship (Baxter et al. 2010). Because the longfin smelt population is at very low abundance compared to historic abundance, a greater number of longfin smelt at a given life stage tends to give greater numbers during the subsequent life stages; this therefore suggests that any negative effects of the EDB in one year (e.g., from construction or predation) could be compounded by subsequent negative effects in one or more consecutive years. In contrast, implementation of the project in three non-consecutive years out of ten years may avoid such compounding effects as there presumably would be more opportunity for the longfin smelt population to compensate for any negative effects in a given year. Although it is possible that compounding effects of the EDB with three consecutive years of implementation could occur, the magnitude of any such effect is unknown and it is concluded that this effect cannot be estimated with currently available analytical tools.

5.4.2 Swainson's Hawk

It is difficult to predict whether implementation of the project in consecutive years could have a more detrimental effect on Swainson's hawk than implementation in three years spread more evenly through the 10-year period. Pairs that nest near enough to any of the project sites to experience, but tolerate, disturbance during barrier installation in one year may be less likely to persist with nesting at or near the site if the barrier is installed in the following year. However, it is also possible that if the initial nesting attempt was not substantially disrupted, the pair would be likely to accept the disturbance in subsequent years, particularly if the initial nesting attempt was successful. Similar behavior has been observed on DWR's Temporary Barriers Project where a pair of Swainson's hawks has repeatedly nested successfully in very close proximity to a barrier site (Tsao, pers. comm., 2014). The potential for Swainson's hawks to abandon of nest site as a result of barrier installation in consecutive years is difficult to assess, because it would depend on a number of variables that cannot be predicted at this time, such as the timing of installation, timing of the nesting attempt, and behavioral characteristics of the particular nesting pairs. Therefore, as with longfin smelt, the magnitude of any potential adverse effect from barrier installation in consecutive years cannot be reliably assessed.

5.5 Emergency Implementation Earlier Than Proposed Dates

5.5.1 Longfin Smelt

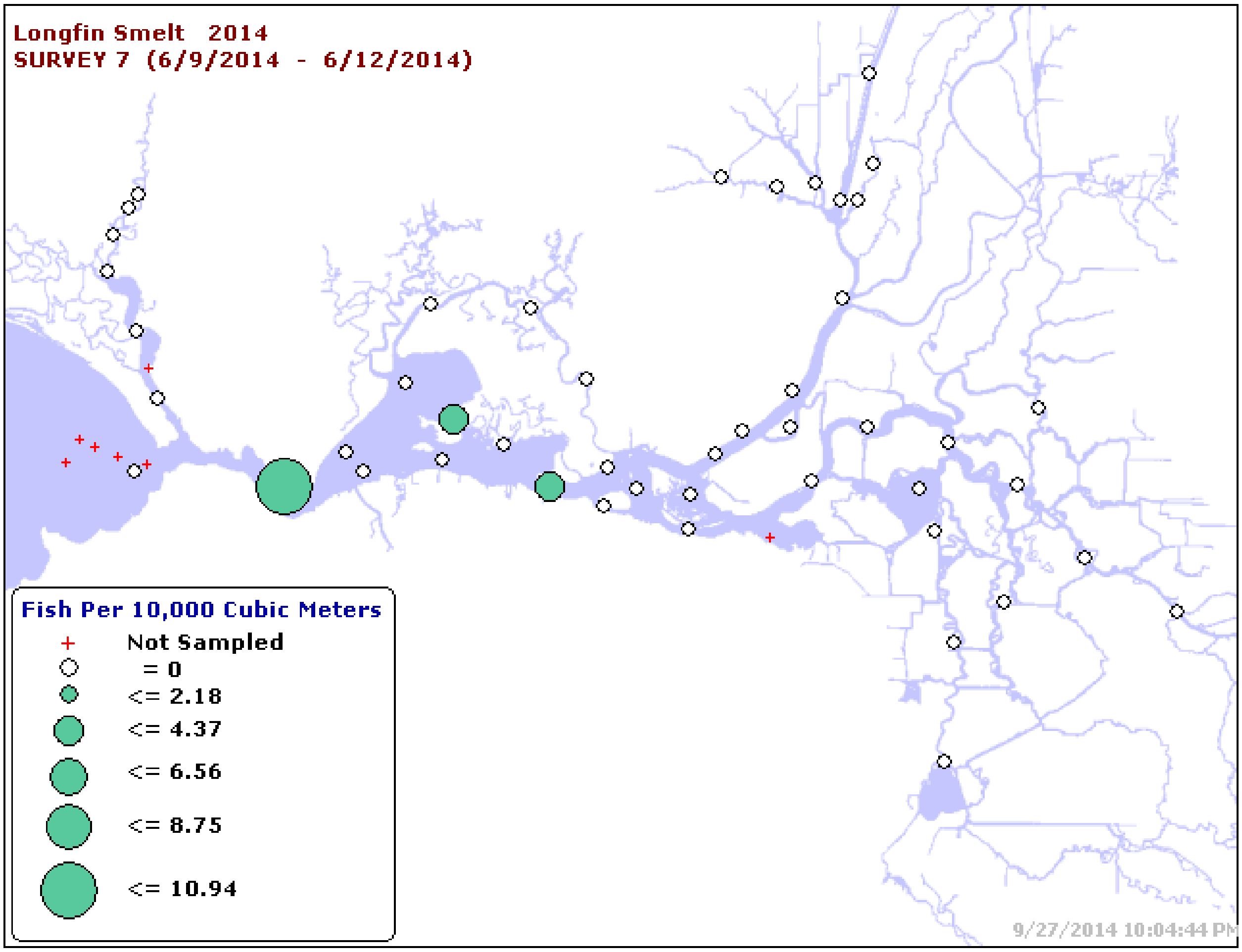
The potential for effects on longfin smelt from the EDB generally would be expected to increase with emergency implementation of the project earlier than the dates proposed in the Project Description (i.e., construction beginning no earlier than May 7 for the West False River barrier, and no earlier than May 22 for the Sutter and Steamboat slough barriers). The Smelt Larval Survey and 20-mm Survey in 2014 illustrate that the distribution of the early life stages moves downstream in early June (Table 6; Figure 13), whereas prior to this, appreciable numbers of larvae and early juveniles were found in the vicinity of the EDB (at West False River, and other locations further upstream; Figure 14). Therefore, implementation of the project earlier than May/June would have greater potential for the types of construction and operations impacts to longfin smelt that were discussed above in sections 5.2 *Construction and Removal Impacts* and 5.3 *Operations Impacts*.

Table 6. Center of Density of Longfin Smelt Collected in the 2014 Smelt Larval Survey and 20-mm Survey.

Smelt Larval Survey		20-mm Survey	
Survey Number (Dates)	Center of Density[1]	Survey Number (Dates)	Center of Density[1]
1 (Jan 6-8)	0.3	1 (Mar 3-17)	-1.9
2 (Jan 21-23)	-9.6	2 (Apr 2-4)	3.3
3 (Feb 3-5)	-5.2	3 (Apr 14-17)	7.9
4 (Feb 18-20)	-0.7	4 (Apr 28-May 1)	4.7
5 (Mar 3-5)	4.2	5 (May 12-15)	-0.9
6 (Mar 3-17)	2.3	6 (May 27-Jun 2)	3.6
		7 (Jun 9-12)	20.4
		8 (Jun 23-26)	27.0
		9 (Jul 7-10)	None collected

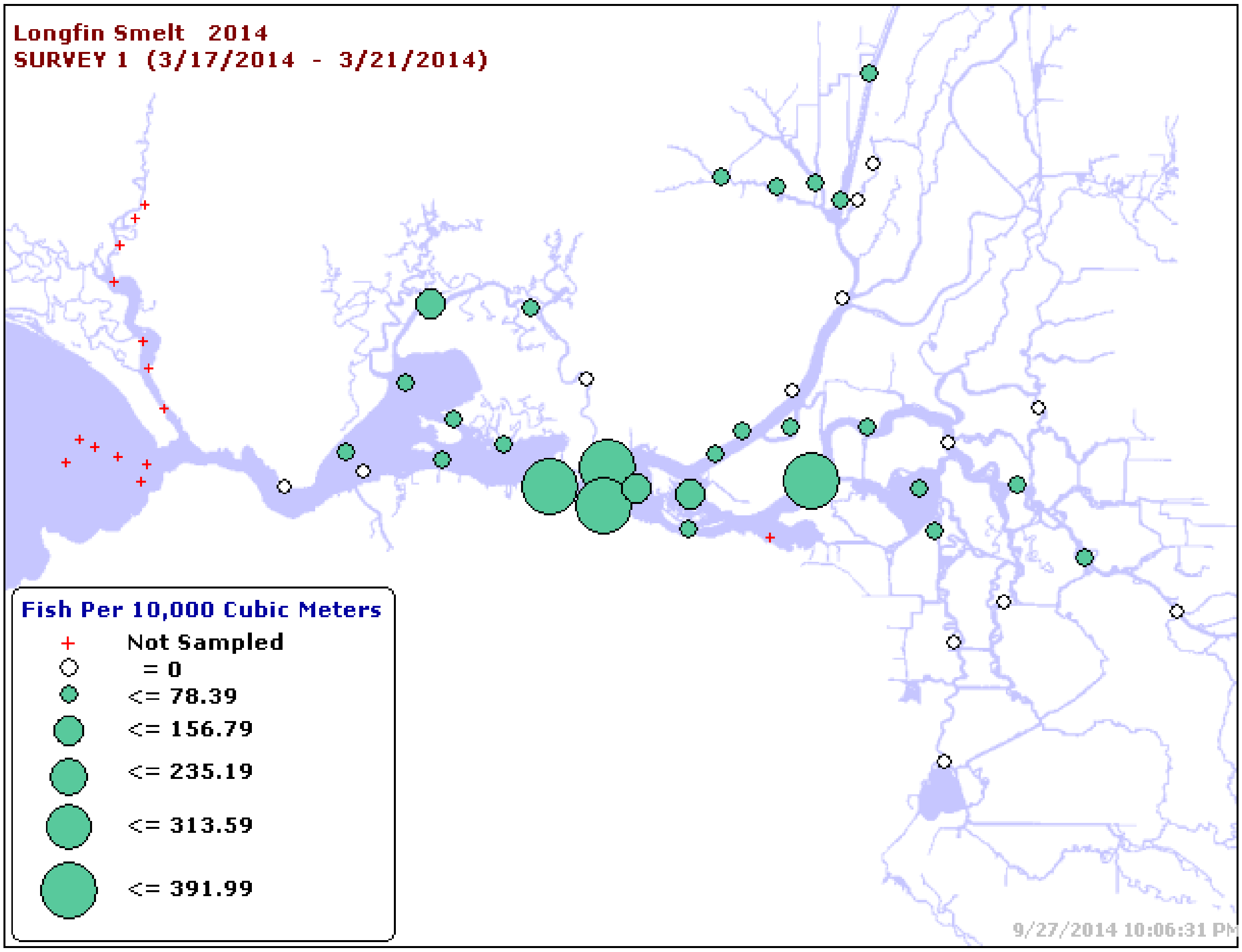
Source: http://www.dfg.ca.gov/delta/data/sls/CPUE_Map.asp and http://www.dfg.ca.gov/delta/data/20mm/CPUE_Map3.asp. Accessed: September 27, 2014.

[1] Kilometers downstream (positive numbers) or upstream (negative numbers) from the confluence of the Sacramento and San Joaquin Rivers.



Source: http://www.dfg.ca.gov/delta/data/20mm/CPUE_Map3.asp

Figure 13. Longfin Smelt Density from 20-mm Survey 7 of 2014.



Source: http://www.dfg.ca.gov/delta/data/20mm/CPUE_Map3.asp

Figure 14. Longfin Smelt Density from 20-mm Survey 1 of 2014.

5.5.2 Swainson's Hawk

The potential for adverse effects on Swainson's hawk could increase if the barriers are installed earlier than proposed (prior to May 7 for the West False River barrier and May 22 for the Sutter and Steamboat slough barriers). In general, nesting Swainson's hawks are more likely to abandon a nesting attempt earlier in the nest cycle. Therefore, installing a barrier during nest building and egg-laying (generally early to late April) or early in the incubation period (generally late April through May) could be more likely to result in abandonment of a nest located very near the barrier site than later in the nest cycle. In contrast, initiating barrier installation before Swainson's hawks return to their breeding territories or very early in the nesting cycle (prior to early April) could reduce potential adverse effects by allowing nesting pairs to re-locate to an alternative nest site before they have invested a great deal of energy in nest-building or egg-laying. Therefore, it is difficult to make a general conclusion regarding potential adverse effects of early installation, because it could depend largely on the timing of the installation in relation to the Swainson's hawk nesting cycle.

5.6 Removal of West False River Barrier Later Than Proposed Date

As noted in the Project Description, the West False River Barrier is proposed to be fully removed by November 15. However, the size of the barrier and the logistical challenges its removal presents could result in removal extending beyond November 15, up to November 30.

5.6.1 Longfin Smelt

In general, the potential for effects on longfin smelt from removal of the West False River barrier generally would be expected to increase somewhat with removal by November 30 compared to removal by November 15. As the water in the Delta cools, it would be expected that a portion of the adult longfin smelt population would move upstream to spawn (Baxter et al. 2010) and therefore would have more potential to occur in the West False River barrier area. Full removal of the West False River barrier later than November 15 and as late as November 30 would increase the likelihood of overlapping upstream migration. In general, later removal therefore would somewhat increase the potential to affect longfin smelt by the mechanisms described above in the the sections discussing Construction and Removal Impacts.

5.6.2 Swainson's Hawk

Potential for effects on Swainson's hawk would not change if removal of the West False River is completed later than planned. Because removal would occur outside of the nesting season, there is no potential for such a delay to result in take of Swainson's hawk. In fact, very few, if any Swainson's hawks would be present in the vicinity of the project sites during barrier removal.

6. Potential for Jeopardy

Considering the relatively small spatial and temporal scale of the EDB, coupled with the small proportion of the Covered Species' populations that would be likely to occur in the project area and potentially be impacted by the EDB, as well as the inclusion of many environmental commitments (see section 3.8 *Environmental Commitments*), issuance of an incidental take permit for EDB construction and operation would not jeopardize the continued existence of the Covered Species.

7. Proposed Minimization and Mitigation Measures

Application of the measures described in section 3.8 *Environmental Commitments* would result in additional minimization and mitigation measures being unnecessary.

8. Monitoring and Reporting

DWR will submit to CDFW a Final Mitigation and Monitoring Report by December 31, 2015. This report will include: 1) a synthesis of the results and conclusions of the monitoring program; 2) an assessment of the effectiveness of all Conditions of Approval in minimizing and mitigating project impacts; and 3) recommendations on how environmental commitments/mitigation measures might be changed to more effectively minimize and mitigate impacts of similar future projects on the Covered Species.

9. Funding

In the event there is take, DWR will ensure funding to complete the proposed environmental commitments/mitigation measures, including acquisition of mitigation lands or credits. The certification of this application by the DWR Principal Officer below provides this assurance.

10. Certification

I certify that the information submitted in this application is complete and accurate to the best of my knowledge and belief. I understand that any false statement herein may subject me to suspension or revocation of this permit and to civil and criminal penalties under the laws of the State of California.

By:	______________________	Date:	______________________
Printed Name:	______________________	Title:	______________________

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Appendix A
Design Details for the Emergency Drought Barriers Project

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Design details for the Emergency Drought Barriers Project based on the most recent construction drawings are available to download from the DWR Bay-Delta Office portal at the following URL: https://bdo-portal.water.ca.gov/south-delta-branch/-/document_library/view/215850;jsessionid=A7E2895D9F4476650B2BDE13F8571297

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